August 2022
Terminal 25 South Site

Engineering Evaluation and Cost Analysis Work Plan

Prepared for the Port of Seattle

Port of Seattle

DRAFT

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Project Number: 210003-03.01 Task 2

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ABBREVIATIONS

µg/kg	micrograms per kilogram
AET	Apparent Effects Threshold
ARAR	Applicable or Relevant and Appropriate Requirement
ASAOC	Administrative Settlement Agreement and Order on Consent
BEI	Blymyer Engineers, Inc.
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	contaminant of concern
COPC	contaminants of potential concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CSL	cleanup screening level
CSM	conceptual site model
CSO	combined sewer outfall
CWA	Clean Water Act
D/F	dioxins/furan
DDT	dichlorodiphenyltrichloroethane
DQ	data quality
DQO	data quality objective
EE/CA	Engineering Evaluation and Cost Analysis
EPA	Environmental Protection Agency
ERA	Ecological Risk Assessment
ESA	Environmental Site Assessment
EW	East Waterway
FS	Feasibility Study
HHRA	Human Health Risk Assessment
LDW	Lower Duwamish Waterway
LUST	leaking underground storage tank
MLLW	mean lower low water
MTCA	Washington State Model Toxics Control Act
NAVD88	North American Vertical Datum of 1988
NOAA	National Oceanic and Atmospheric Administration
NRDA	Natural Resource Damage Assessment
NTCRA	Non-Time Critical Removal Actions
OC-normalized	organic carbon-normalized

OU	Operable Unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PRG	preliminary remediation goal
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RAL	remedial action level
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
SCO	Sediment Cleanup Objectives
Site	Terminal 25 South Site
SL	screening level
SMS	Sediment Management Standards
SOW	Statement of Work
SPU	Seattle Public Utilities
SQAPP	Sampling, Analysis, and Quality Assurance Project Plan
SRE	streamlined risk evaluation
SRI	Supplemental Remedial Investigation
SSA	Stevedoring Services of America
SVOC	semivolatile organic compound
TBT	tributyltin
TCLP	toxicity characteristic leaching procedure
TEQ	toxic equivalents quotient
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TSCA	Toxic Substance Control Act
UST	underground storage tank
VOC	volatile organic compound
WAC	Washington Administrative Code
WQC	Water Quality Criteria
WQS	Water Quality Standards

1 Introduction

This Draft Engineering Evaluation and Cost Analysis (EE/CA) Work Plan has been prepared by Anchor QEA, LLC, on behalf of the Port of Seattle (Port), referred to herein as "the Respondent," for the Terminal 25 South Site (Site) located at 2917 East Marginal Way South, Seattle, Washington (Figure 1-1). This EE/CA Work Plan has been prepared under the Administrative Settlement Agreement and Order on Consent (ASAOC; Comprehensive Environmental Response, Compensation, and Liability Act of 1980 [CERCLA] Docket No. 10-2022-0159) executed between the Respondent and the United States Environmental Protection Agency (EPA; 2022). The Statement of Work (SOW) for the Site is Appendix B to the ASAOC and sets forth the requirements for the Removal Action EE/CA.

The Site is located along the southeast portion of the East Waterway (EW) Operable Unit (OU) of the Harbor Island Superfund Site (East Waterway). EPA is overseeing cleanup studies in the EW under an existing ASAOC with the Port (EPA Docket No. CERCLA-10-2007-0030). The EW, located south of downtown Seattle, stretches 1 mile along Harbor Island between the end of the Lower Duwamish Waterway and Elliott Bay (Figures 1-1 and 1-2). The EW has been part of Seattle's main industrial corridor with Elliott Bay and Puget Sound since it was formed in the early 1900s and is hydraulically connected to the Lower Duwamish Waterway (LDW). The EW is tidally influenced.

The EW OU is one of eight OUs of the Harbor Island Superfund Site that were added to the EPA National Priorities List in 1983. A Final Supplemental Remedial Investigation Report (SRI; Windward and Anchor QEA 2014) was approved by EPA in 2014 and includes the *Baseline Human Health Risk Assessment* (HHRA; Windward 2012a), *Baseline Ecological Risk Assessment* (ERA; Windward 2012b), and assembled data to identify the nature and extent of sediment contamination in the EW, evaluate sediment transport processes, and identify potential sources and pathways of contamination to the EW. The *Final Feasibility Study* (FS; Anchor QEA and Windward 2019a), approved by EPA in 2019, develops and evaluates EW-wide remedial alternatives to address potential risk posed by contaminants of concern (COCs) within the EW. EPA has indicated it intends to release a Proposed Plan in 2022 that will recommend a preferred sediment remedy and cleanup plan. After public, state, and tribal comments on the Proposed Plan, EPA will select the final remedial alternative in the Record of Decision (ROD).

The Port and the Natural Resource Trustees (Trustees) are engaged in negotiations to settle claims of natural resource damages for the LDW and Harbor Island Sites. As an outcome of those negotiations, the Port intends to construct a habitat restoration project at the Site (Figure 1-3), which would restore intertidal and shallow subtidal habitat by removing contaminated sediments from the EW and contaminated soil from the adjacent upland to create off-channel emergent marsh and riparian habitat. The Site is in a critical estuarine and marine transition area that is important to juvenile salmon. The removal action will occur ahead of habitat restoration construction activities, likely as part of the same construction effort. It is expected that the removal action conducted within the existing sediment areas of the EW OU performed in advance of the eventual remedial action for the other sediment areas of the EW OU would provide for a cleanup of contamination to support the habitat restoration project. The habitat restoration also includes restoration of a riparian buffer along the new southern and eastern shorelines and a stormwater feature to the east (Figure 1-3).

1.1 Objectives of the Engineering Evaluation and Cost Analysis

The primary objectives of the EE/CA, as set forth in the SOW, are as follows:

- Evaluate the adequacy of previously screened data, identify data gaps, and develop a sampling plan for necessary media and a groundwater monitoring plan for any data gaps that need to be filled to characterize the Site.
- Present a conceptual site model (CSM) that determines complete and incomplete contamination migration pathways and exposure pathways and evaluates receptors and exposure scenarios.
- Evaluate the potential human health and ecological risks posed by Site contaminants of potential concern (COPCs) for complete pathways and receptors that are not already addressed in the EW Supplemental Remedial Investigation/Feasibility Study (SRI/FS) through a streamlined risk evaluation (SRE). Any Site COPCs not already identified by the EW SRI/FS will also be evaluated.
- Identify removal action objectives and evaluate removal action alternatives for the Site, if appropriate. The removal action objectives need to address the following:
  - Direct contact exposure to people and protection of benthic invertebrates, juvenile salmon, flatfish, and specific bird assemblages following habitat restoration
  - Evaluation of potential recontamination of the Site from adjacent upland areas and the EW; adjacent upland areas include the remainder of the terminal and adjacent rights-of-way

The EE/CA will be conducted in accordance with the ASAOC and removal action requirements under 40 Code of Federal Regulations (CFR) 300.415, EPA's Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA (EPA 1993), and other published EPA policy and guidance for conducting removal actions. Attachment 1 of the SOW includes a list of major deliverables and a schedule for their submittal. Deliverables required by the ASAOC or SOW are subject to EPA review and approval. The four tasks identified in the SOW include the following:

1. Preparing this EE/CA Work Plan, including the following appendices:
   a. Sampling, Analysis, and Quality Assurance Project Plan
   b. Health and Safety Plan
2. Implementing the EE/CA Work Plan
3. Preparing the EE/CA

4. Community Involvement Activities

1.2 Purpose and Scope of the Engineering Evaluation and Cost Analysis Work Plan

As discussed in Section 1.1, the preparation of this EE/CA Work Plan is Task 1 of the requirements identified in the SOW. The primary purpose of this EE/CA Work Plan is to present the preliminary CSM and conduct an evaluation of data gaps that need to be filled to complete the EE/CA.

The data gaps analysis in this EE/CA Work Plan specifically addresses whether existing Site characterization data are adequate to support 1) preparation of an EE/CA and 2) implementation of a removal action. This EE/CA Work Plan provides a summary of the existing soil, sediment, biota, and groundwater data for the Site, relevant EW sediment data, and data from adjacent properties. It evaluates the sufficiency of the existing data for characterizing contamination sources, determining the nature and extent of contamination in the future marsh area and existing EW sediments within the Site, and identifying complete migration pathways to the future marsh area and EW sediments within the Site following habitat restoration. It also evaluates preliminary data gaps relative to assessing the potential for recontamination of existing EW sediments and sediments created through the Site habitat restoration. The preliminary CSM presented in this EE/CA Work Plan considers contamination from upland sources and groundwater migration to the Site following habitat restoration.

The data gaps analysis considers the completeness of existing data and determines the significance of exposure pathways to be evaluated. The preliminary CSM includes pathways evaluated in the EW HHRA (Windward 2012a) and Baseline ERA (Windward 2012b) and considers the Environmental Cleanup Best Management Practices: Effective Use of Project Life Cycle Conceptual Site Model, EPA 542-F-11-011, July 2011 (EPA 2011). The data gaps analysis specifically evaluates whether sufficient data are available to conduct a streamlined HHRA and streamlined ecological risk evaluation for any COPCs and complete pathways and receptors not already evaluated in the EW SRI/FS documents. The data gaps analysis also evaluates the potential for recontamination of sediments at concentrations exceeding EW Remedial Action Levels (RALs; Anchor QEA and Windward 2019a Table 6-1) and Preliminary Remediation Goals (PRGs; Anchor QEA and Windward 2019a Table 4-4) as anticipated in the forthcoming Proposed Plan and ROD and Lower Duwamish River NRDA Trustee Injury Thresholds (Injury Thresholds; NOAA 2013). Further assessment of risks to benthic invertebrate and ecological receptors and human consumption of seafood and sediment direct contact is not required, as actions needed to address those risks within the existing EW sediments will be decided in the EW ROD.

1.3 Project Team and Responsibilities

The project team for the Site EE/CA is as follows and depicted in the organization chart in Figure 1-4.

1.3.1.1 Regulatory and Agency Management

- Ravi Sanga from EPA will serve as the Remedial Project Manager with responsibility for overseeing the implementation of the ASAOC and associated SOW. All submittals required by the ASAOC and SOW will be delivered to the EPA Remedial Project Manager.
- Erika Hoffman from EPA will perform technical review of submittals.
- The Trustees will review submittals and provide comments in coordination with EPA. The Trustees include representatives from the National Oceanic and Atmospheric Administration (NOAA), Washington State Department of Ecology (Ecology), United States Department of the Interior, United States Fish and Wildlife Service, Muckleshoot Indian Tribe, and the Suquamish Tribe.

1.3.1.2 Port Management

- The Port is the Respondent to the ASAOC and is working to implement the ASAOC.
- Joanna Florer is the Project Manager on behalf of the Port. The Port manager is the primary contact for the Port.

1.3.1.3 Technical Team

- Dan Berlin, Professional Wetland Scientist, of Anchor QEA is the designated Project Coordinator for the Site EE/CA. As such, he will coordinate all activities with the EPA Remedial Project Manager and is responsible for the administration of all actions required by the ASAOC. Mr. Berlin is also the Technical Project Manager, responsible for overall project coordination and planning to ensure the timely and successful completion of the project. Mr. Berlin oversees the consultant team and reviews all reports and work products.
- Julia Fitts, Licensed Geologist, of Anchor QEA is the Assistant Project Coordinator/Manager and will support coordination with the EPA Remedial Project Manager and project coordination and planning tasks.
- John Laplante, Professional Engineer, of Anchor QEA is a professional engineer in the State of Washington serving as the Engineer of Record and providing engineering oversight for the EE/CA.
- The Port has retained Anchor QEA, LLC, to conduct the EE/CA for the Site. Seven subconsultants will be used to complete the work, including Stepherson and Associates serving in a key role in the project team.
- Josh Stepherson of Stepherson and Associates (a subconsultant to Anchor QEA) will lead community involvement and outreach related to the Site EE/CA and also serve as Diversity

Coordinator to monitor and ensure utilization of Women/Minority Business Enterprises throughout the project.

- Amy Nelson of Anchor QEA is the Toxicologist/Risk Assessor for the EE/CA and is responsible for developing the CSM and conducting the streamlined risk assessment and recontamination analysis.
- Sylian Rodriguez, PhD, of Anchor QEA is overseeing the removal action alternative analysis of the EE/CA Report.
- Delaney Peterson of Anchor QEA is the Field Investigation Lead and will lead development and implementation of the field sampling program.

1.4 Engineering Evaluation and Cost Analysis Work Plan Organization

This EE/CA Work Plan is organized as follows:

- Section 2, Background and Setting, describes the Site location and summarizes the environmental setting; geology and hydrogeology; natural and cultural resources; current and historical uses and operations and environmental investigations of the Site and adjacent properties; prior remedial actions at the Site, database development, EW OU data, and the nature and extent of contamination at the Site based on the currently available data.
- Section 3, Streamlined Risk Evaluation Approach, COPC Identification, and Conceptual Site Model, describes the streamlined risk evaluation approach that will be used in the EE/CA, identifies preliminary COPCs based on the currently available data, and presents the preliminary CSM.
- Section 4, Identification of Removal Action Goals and Objectives and Regulatory Requirements and Guidance, describes the removal action goals, objectives, and Site use considerations. It describes the goals and objectives of the recontamination assessment that will be conducted as part of the EE/CA and presents a preliminary review and analysis of the applicable regulatory requirements and guidance.
- Section 5, Data Gaps Assessment and Investigation Approach, presents the initial and potential data needs required to fill data gaps based on the review of existing data, identifies the data quality objectives (DQOs) to meet the initial data needs, describes the EE/CA data gaps investigation approach (investigation areas, media to be sampled, and chemical analyses) necessary to meet the DQOs, and describes an adaptive management process for evaluating initial data, determining additional data needs, updating DQOs, and scoping and implementing additional data collection.
- Section 6, Approach to the Selection of Removal Action Alternatives, identifies the range of potential alternatives that are currently envisioned for the EE/CA, describes the process for evaluating and selecting the removal action alternative, and describes how the selected alternative will be detailed in the EE/CA Report.
- Section 7, References, presents a list of the references cited within this EE/CA Work Plan.

- Appendix A, Supplemental Data, includes the following attachments: Boring Logs and Monitoring Well Construction Table for Existing Explorations; Data Quality-2 Data presents the data that were classified as not meeting the Data Quality-1 requirements described in Section 2.10.2; and Resource Conservation and Recovery Act (RCRA) and Toxic Substance Control Act (TSCA) Data Screening.
- Appendix B, Sampling, Analysis, and Quality Assurance Project Plan (SQAPP), describes the detailed sampling and analytical methodologies and quality assurance (QA)/quality control (QC) protocols that will be used during the soil, groundwater, and pre-design engineering investigations to collect data needed to characterize the Site, support the EE/CA, and support the removal action and habitat restoration design.
- Appendix C, Health and Safety Plan, describes the health and safety procedures that will be followed during the implementation of the EE/CA field investigations.

2 Background and Setting

This section describes the operational and regulatory history of the Site and the surrounding properties. It describes the Site location and summarizes the environmental setting; geology and hydrogeology; natural and cultural resources; current and historical uses and operations and environmental investigations of the Site and adjacent properties; prior remedial actions at the Site; database development; EW Site data; and the nature and extent of contamination based on the currently available data.

2.1 Site Location and Description

Terminal 25 is located at 2917 East Marginal Way South, Seattle, Washington, and consists of a single parcel that is owned and managed by the Port of Seattle. The parcel (Assessor's Parcel Number 7666207905) is approximately 37 acres in size. The Site includes approximately 5 acres of upland area generally located at the southwestern portion of the parcel and 5 acres of submerged and intertidal areas within the footprint of the EW OU. Most of the Site within the EW OU is state-owned land managed by the Washington State Department of Natural Resources, but a portion is owned by the Port of Seattle. The Site is bounded to the east by the NW Seaport Alliance Lease Area, to the south by Spokane Street, to the west by the remaining EW OU and to the north by the active terminal facility (Figure 2-1). The upland portion of the Site parcel and surrounding properties are zoned Industrial General 1.

2.2 Environmental Setting

2.2.1 Bathymetry and Topography

The Site shoreline is an armored, riprap slope that connects the uplands with the EW. A treated-wood piling field from the historical Pier 24 remains in the subtidal area on the northern half of the Site. Bathymetry of -15 to -20 feet mean lower low water (MLLW) leads into the channel from the piling field (Figure 2-2). Towards the southern edge of the shoreline, the bathymetry is shallower and depths are between 0 and -5 feet MLLW.

The upland topography at the Site is relatively flat with a ground surface elevation in the upland area ranging from +12 to +16 feet MLLW. MLLW is an area-specific vertical datum based on observed tidal fluctuation that can be converted to other datums such as North American Vertical Datum of 1988 (NAVD88). For the purpose of the EE/CA, the vertical datum conversion based on NOAA Tidal Station 9447130 (at Colman Dock) is as follows:

Tidal Datums at Seattle, Washington (NOAA Tidal Station 9447130)

Tidal Datum	Elevation (feet relative to MLLW)	Elevation (feet relative to NAVD88)
Highest Observed Tide	14.5	12.2
Highest Astronomical Tide (HAT)	13.3	11.0
Mean Higher High Water (MHHW)	11.3	9.1
Mean High Water (MHW)	10.5	8.2
Mean Sea Level (MSL)	6.6	4.3
Mean Low Water (MLW)	2.8	0.5
North American Vertical Datum (NAVD88)	2.3	0
Mean Lower Low Water (MLLW)	0	-2.3

Site bathymetric and topographic contour elevations are depicted in Figure 2-2.

2.2.2 Beneficial Use of Groundwater

Groundwater within the Site would be classified as non-potable in accordance with the Washington State Model Toxics Control Act (MTCA) regulation (Washington Administrative Code [WAC] 173-340-720(2)), as follows:

- (2)(a) The groundwater does not serve as a current source of drinking water. Groundwater at the Site property is not used for any purpose. Under King County regulations, private wells can only be used for potable water supply in an urban area if a property is "...unable to receive water service in a timely and reasonable manner or with reasonable economy and efficiency from any public water system" (King County Code 13.24.140[B][1][c]). The Site is within City of Seattle's municipal water service area and this potable water supply will continue into the foreseeable future.
- (2)(b) The groundwater is not a potential future source of drinking water due to low yield or naturally poor water quality. Naturally brackish groundwater conditions occur throughout the Site water-bearing units due to proximity to the EW (saltwater intrusion) and the fact that much of the fill was dredged from the marine environment. This is demonstrated by existing measurements of electrical conductivity in Site groundwater commonly exceeding state secondary maximum contaminant levels for drinking water (i.e., greater than 700 micromhos per centimeter; WAC 246-290-310).
- (2)(c) It is unlikely that hazardous substances will be transported from the contaminated groundwater to groundwater that is a current or potential future source of drinking water, as defined in (a) and (b) of this subsection, at concentrations that exceed groundwater quality criteria published in chapter 173-200 WAC. There are no drinking water wells within the Site, and the EW forms the downgradient limit of the shallow water-bearing units on the Site.

- (2)(d) There is an extremely low probability that the groundwater will be used for that purpose because of the Site's proximity to surface water that is not suitable as a domestic water supply. At such sites, groundwater may be classified as non-potable if each of the following conditions can be demonstrated:
  - (i) There are known or projected points of entry of the groundwater into the surface water. Groundwater from the Site discharges to the EW.
  - (ii) The surface water is not classified as a suitable domestic water supply source under chapter 173-201A WAC. The EW is a marine surface waterbody and does not classify as a domestic water supply in Table 602 of Chapter 173-201A WAC.
  - (iii) The groundwater is sufficiently hydraulically connected to the surface water that the groundwater is not practicable to use as a drinking water source. Because of its substantial hydraulic connection with the EW, it is not practicable to use Site groundwater as a drinking water source due to the potential for drawing saline water into the water-bearing zone (e.g., saltwater intrusion).

Based on this collective information, the Site SRE and EE/CA remedial action objectives (RAOs) assume that Site groundwater is not, and will not be in the future, a source of potable water supply. Any removal action will protect discharge to EW sediment and surface water as the highest beneficial use for Site groundwater.

2.2.3 East Waterway Operable Unit

The Site is located within the EW OU and within the source control area of the EW OU of the Harbor Island Superfund Site. The overall strategy for addressing contamination in the EW OU includes removal of contaminated sediment and controlling sources of contamination to the waterway from upland areas. In accordance with EPA guidance and prudent practice, remedial actions should occur following source control implementation and verification.

The Port is the Respondent for the EW OU cleanup studies (ASAOC EPA Docket No. CERCLA-10-2007-0030) and for the EE/CA (ASAOC Docket No. 10-2022-0159), but will coordinate with other parties regarding any source control activities needed to support the removal action and habitat restoration. This includes the East Waterway Group parties (King County and City of Seattle), who entered into a Memorandum of Agreement with the Port to jointly conduct the EW OU cleanup studies but not the EE/CA or subsequent removal action or restoration activities. The East Waterway Group currently coordinates and implements source control efforts in the EW and works in cooperation with local jurisdictions, Ecology, and EPA to implement source control actions. The ongoing source control efforts in the EW are not anticipated to impact the timing of planned remediation in the EW OU (Anchor QEA and Windward 2019a). Additionally, the potential for recontamination of the removal action and Restoration Area from potential sources will be evaluated by the Port as part of the EE/CA as described in Section 4.3.

EPA will lead the sediment cleanup and is preparing to issue a Proposed Plan, which will set forth the preferred remedial action alternative for the cleanup of sediments in the EW OU. EPA will administer the final Selected Remedy for EW that will be identified by EPA in the ROD.

The risks from human consumption of seafood and sediment direct contact in EW are assessed in the Baseline HHRA and Baseline ERA conducted as part of the EW OU SRI/FS (Windward and Anchor QEA 2014). Actions needed to address these risks are addressed in the EW FS (Anchor QEA and Windward 2019a). As such, the evaluation of potential human health and ecological risks associated with the Site will be streamlined to only include the complete pathways and receptors that are not already addressed in the EW SRI/FS. Any Site COPCs not already identified in the EW FS (based on a review of existing Site data as described in Section 2.10.2) will also be evaluated.

Figure 2-3 depicts the anticipated sediment remedial technologies in the EW OU that may be required, based on the EW FS (Anchor QEA and Windward 2019a). However, the final Selected Remedy, remediation areas and technologies will be confirmed in the EW ROD.

2.3 Geology and Hydrogeology

This section provides an overview of the Site geologic and hydrogeologic conditions as currently understood based on prior investigations. Existing boring logs providing subsurface geologic information for the Site and adjacent properties have a typical depth of 10 to 20 feet below ground surface (bgs) and a maximum depth of 81.5 feet bgs. Appendix A provides available boring and sediment core logs from prior investigations conducted on the Site or adjacent EW. Appendix A also includes a tabulation of available well construction information (e.g., screen depths and elevations) for monitoring wells at the Site.

2.3.1 Regional Geologic Setting

The Site is located within the Duwamish River Valley, a topographic basin south of downtown Seattle that extends from the origin of the Duwamish River, at the confluence of the Green and Black Rivers in Tukwila, to the river mouth at Elliott Bay. The Duwamish Valley rests in a north-south trending, glacially scoured trough bounded by glacial drift uplands deposited during repeated Pleistocene glaciations (approximately 15,000 years ago). The trough contains post-glacial alluvium up to 200 feet thick (Weston 1993) and includes the waters of the Duwamish River, the EW and West Waterway. The trough is bounded by upland plateau regions composed of thick sequences of Pleistocene glacial deposits.

The regional stratigraphy of the Greater Duwamish Valley include bedrock, glacial and non-glacial sedimentary deposits, and Duwamish Valley alluvial deposits, which include channel fill deposits resulting from dredging activities of the Duwamish River. These geologic assemblages are described in the LDW SRI (Windward 2010) and EW SRI (Windward and Anchor QEA 2014). The geologic history and stratigraphy at the Site is described below.

2.3.2 *Site Geology*

During the late 1800s, the Site was located at the northern tip of a small island at the eastern side of the mouth of the Duwamish River. The remainder of the Site was within the river channel or adjacent estuarine mudflats of the Duwamish River delta.

The Site was initially constructed by dredging and filling activities in the early 1900s, when the Duwamish River was reconfigured to the current channel location. In addition to sediment fill placement at the Site, other upland fill materials (associated with the regrading of Beacon Hill and Denny Hill) were placed.

The Site is relatively flat. The fill over much of the Site is composed of silty and sandy soils from the upland regrading sources and silty and sandy sediments from the dredging of the Duwamish channel. On-Site fill also includes wood debris (sawdust and fragments) in some areas.

A former turning basin north of the Site (in the EW) was filled in 1972 to create the existing container terminal area.

The geological units at the Site are as follows, from shallowest to deepest (Figure 2-4):

- Upland area:
  - Upland Fill Unit (dredge and fill materials, including some wood debris)
  - Upland Area Lower Alluvium
- EW Sediments:
  - Recent Sediments
  - Upper Alluvium/Transition
  - Lower Alluvium

The two geological units are described below, and their vertical distribution to a depth of approximately 81 feet bgs is depicted on Figure 2-4.

2.3.2.1 Upland Fill Unit

The Upland Fill Unit is the surficial geologic unit in the upland area of the Site, which extends to depths of approximately 15 to 16 feet bgs. Based on observations from previous Site investigations, including recent borings from 2019 and 2020, the Upland Fill Unit consists of unconsolidated sand with varying amounts of silt and gravel. In some areas, substantial wood debris (i.e., a layer of wood fragments and sawdust of varying thickness) is present within the Fill Unit, typically 10 to 15 feet bgs.

2.3.2.2 Upland Area Lower Alluvium

Stratigraphically below the Upland Fill Unit at approximately 15 to 19 feet bgs is the native alluvium, herein termed the Upland Area Lower Alluvium, which corresponds with the young alluvium unit described in the EW SRI (Windward and Anchor QEA 2014). Within the Site, the alluvium unit is characterized by dark grey poorly graded sand (Anchor QEA 2021a). The alluvium unit transitions at depth to an older alluvium unit that is characterized by coarse sand with interbedded silt lenses. Based on limited deeper explorations at the Site, the alluvium unit extends to at least 81 feet bgs. Within the Greater Duwamish Valley, this alluvium unit extends to depths greater than 100 feet.

2.3.2.3 Recent Sediments

In the EW, this upper unit consists of recently deposited material dominated by soft to medium stiff organic silt and inorganic silt. Within the Site, recent sediments are characterized by dark grey to black silt with some fine sand and trace organic material that occurs within the top 8 to 10 feet below the mudline. The unit then has a transitional zone encountered between approximately 2 and 9 feet below the mudline before encountering the lower alluvial sands.

2.3.2.4 Upper Alluvium/Transition

This middle unit in the EW forms a transitional bed between Recent and Lower Alluvium units. The Upper Alluvium unit has characteristics that are a mix of the units lying above and below it. It consists of a mixture of silty sand and sandy silt with a higher density and a higher percentage of sand compared with the Recent unit. Within this unit. stratified beds composed of silty sand or silt are commonly present, as well as lenses of silt. Organic silt, layers of decomposed wood, and shell fragments are often present. The Upper Alluvium unit is encountered in subsurface cores between approximately 2 and 10 feet below mudline.

2.3.2.5 Lower Alluvium

The Lower Alluvium in the EW is predominantly sand with laminated beds of silty sand. This native unit typically consists of multicolored sand grains, layers of wood and shells, and grades to a stiff, inorganic silt at depth. Within the Site, the native Lower Alluvium has been encountered in subsurface cores between approximately 5 and 15 feet below mudline.

2.3.3 Upland Area Site Hydrogeology

2.3.3.1 Hydrostratigraphic Units

Each of the upland geologic units described in Section 2.3.2 also represents a hydrostratigraphic unit with distinct characteristics regarding the presence and flow of groundwater, as described below. The presence of upland utility and stormwater corridors may affect current groundwater flow; however, all existing subsurface utilities and stormwater infrastructure will be removed from the upland area during Site habitat construction.

2.3.3.1.1 Upland Fill Unit

All existing Site monitoring wells were installed within the unconfined Upland Fill Unit. Based on a groundwater investigation that included three wells in 1990, groundwater was encountered in the Upland Fill Unit above and below wood debris. The analysis of the water level measurements with respect to tide stage and cycle suggests that Site groundwater flow is generally west toward the EW OU (Anchor QEA and Aspect 2012).

In 2011, additional groundwater wells were installed by Anchor QEA to characterize nearshore groundwater conditions at the Site. Wells were screened in the Upland Fill Unit at approximately 13 to 14.5 feet bgs (Anchor QEA and Aspect 2012). Results from the nearshore well network indicate groundwater elevations of approximately 2.9 feet MLLW at low tide and up to 10.4 feet MLLW at high tide near the Site shoreline.

2.3.3.1.2 Upland Area Lower Alluvium

There are no Site-specific hydrogeologic data for the Upland Area Lower Alluvium unit at the Site. Based on information from comparable Puget Sound shoreline sites, the Upland Area Lower Alluvium unit at the Site is likely an unconfined aquifer with greater uniformity in material type, greater saturated thickness, and higher average permeability than the overlying Fill Unit. Based on regional information, downward vertical gradients generally occur with the Deeper Alluvium to depths ranging from 30 to 50 feet bgs, with upward vertical gradients occurring at greater depths (Booth and Herman 1988).

2.4 Natural Resources

2.4.1 Upland Areas

The upland areas of the Site and surrounding properties have been developed for industrial uses consistent with the City's Industrial land use zoning. No terrestrial and riparian habitat is currently present along the Site bank. The Washington Department of Fish and Wildlife manages the Priority Habitats and Species Program which provides fish, wildlife, and habitat information. The Washington Department of Fish and Wildlife Priority Habitats and Species Program does not identify any priority species or habitats that may occur on the Site or nearby areas.

2.4.2 Aquatic Habitats

Aquatic habitats include those in the intertidal and subtidal areas of the EW within and near the Site. No tidal marsh or mudflat areas area present within the EW. Aquatic habitat at the Site includes the water column and intertidal and subtidal substrates (typically mud, sand, gravel, cobble, or riprap). Habitat at the Site is predominantly deep water with relatively little shallow subtidal and intertidal habitat. A few isolated areas of sloping mud and sand flats and gravel/cobble in the lower intertidal zone are present. Just north of the Spokane Street Bridge, a mound of fill stabilized by rock was placed specifically for habitat restoration purposes to provide shallow water and intertidal habitat.

2.4.3 Biological Communities

The benthic invertebrate community in the EW is generally dominated by annelids, crustaceans, and mollusks. Larger epibenthic invertebrates identified include crab, shrimp, sea stars, anemones, and squid. Clams have been documented in the EW.

Forty-two anadromous and resident fish species reside in or use the EW as a migration corridor. Salmon use the EW and Duwamish River for rearing of juveniles and as a migration corridor for adults and juveniles. Adult salmon found in the Duwamish River and EW spawn mainly in the middle reaches of the Green River and its tributaries (Grette and Salo 1986). Five species of juvenile salmon (Chinook [*Oncorhynchus tshawytscha*], chum [*O. keta*], coho [*O. kisutch*], pink [*O. gorbuscha*], and steelhead [*O. mykiss*]) have been documented in the EW. Juvenile chum and Chinook salmon were the most abundant salmonid species captured in Slip 27 (Taylor Associates 2004; Shannon 2006; Windward 2010). Sockeye salmon have been found upstream in the LDW (Kerwin and Nelson 2000). Juvenile salmon are expected to primarily feed in suitable nearshore habitats.

The most prevalent species identified during beach seine and trawl sampling were Chinook salmon, chum salmon, shiner surf perch (*Cymatogaster aggregata*), and English sole (*Parophrys vetulus*). Fish abundance peaks in late summer to early fall and is generally lowest in winter (Windward and Anchor QEA 2014).

Relatively little EW-specific information is available on bird populations. Formal studies and field observations indicate that up to 87 species of birds use the LDW during at least part of the year to feed, rest, or reproduce. This number is likely lower in the EW due to the absence of riparian, intertidal, and shallow water habitat. Birds, such as cormorants (*Phalacrocorax* spp.), that feed in open water or dive in deeper waters to feed are more likely to frequent the EW under current conditions. Osprey (*Pandion haliaetus*) and bald eagles (*Haliaeetus leucocephalus*) have been observed along the EW, and osprey nests are present elsewhere in the EW near the Site. Great blue heron (*Ardea herodias*) have also been observed using the EW (Blomberg 2007). Waterfowl species often observed in the EW include common and red breasted merganser (*Mergus serrator*), Barrow's goldeneye (*Bucephala islandica*), Canada goose (*Branta canadensis*), and bufflehead (*Bucephala albeola*). Seabirds include pelagic (*Phalacrocorax pelagicus*) and double-crested (*P. auritus*) cormorants, pigeon guillemot (*Cepphus columba*), grebes (*Podiceps* spp.), and gulls (*Larus* spp.; Windward and Anchor QEA 2014).

Three marine mammal species may occasionally enter the EW: harbor seal (*Phoca vitulina*), California sea lion (*Zalophus californianus*), and harbor porpoise (*Phocoena phocoena*; Dexter et al. 1981). Three species of semiaquatic terrestrial mammals are known to forage in the EW, including raccoons (*Procyon lotor*), muskrats (*Ondatra zibethicus*), and river otters (*Lutra canadensis*; Windward and Anchor QEA 2014).

Sixteen aquatic and aquatic-dependent species reported in the vicinity of Elliott Bay area are listed under either the Endangered Species Act or by the Washington Department of Fish and Wildlife as candidate species, threatened species, endangered species, or species of concern. Of these species, Chinook salmon, coho salmon, steelhead salmon, brown rockfish (*Sebastes auriculatus*), bald eagle, western grebe (*Aechmophorus occidentalis*), and Pacific herring (*Clupea pallasii*) are commonly observed in the EW.

The goal of the restoration is to restore estuarine wetland functions across the Site as well as to restore and create riparian habitat and off-channel rearing and refuge habitat for salmonids and other migratory and resident fish and wildlife in the EW.

2.5 Cultural Resources

The Site was deeply subtidal—part of an embayment that extended south as far as present-day Auburn—until the Duwamish River delta began to aggrade about 5,700 years ago after a large eruption of Mount Rainier. The eruption created the Osceola Mudflow, which introduced massive amounts of sediment into the Duwamish drainage and caused the river mouth to move northward as the river valley filled with sediment. The Duwamish River delta was near its historical location by 1,500 to 2,200 years ago, at which time it would have been available for use by Native American communities. An earthquake around 1,050 years ago further uplifted the Lower Duwamish River area, raising the terraces adjacent to the river mouth. The Duwamish River mouth at historic contact was situated in an extensive tide flat area surrounded by higher terraces (Dragovich et al. 1994; Updegrave 2007; Miss et al. 2008).

The Site is located in an area mapped as intertidal in early maps, prior to historical and modern filling. Between 1900 and 1920, U.S. Army Corps of Engineers and private dredging projects straightened the course of the Duwamish River, creating the Duwamish Waterway. The waterway extends about 4.5 miles upstream from the southern extent of Harbor Island, where it meets the Duwamish River. Waterway sediment and upland regrade material was used to build Harbor Island and placed on adjacent properties to either side of the island (Wilma 2001a, 2001b).

After filling created uplands in the Site vicinity, the Site was used for industrial purposes (see Section 2.6.2). There are no standing structures on the parcel. No cultural resources surveys have been conducted at the Site area, and no archaeological sites or historic structures are recorded on the parcel. Potential for cultural resources at the Site is low.

2.6 Site Development and Operations

2.6.1 Site Uses Prior to Development

Prior to the channelization of the Duwamish River in the early 1990s the Site was an undeveloped intertidal area. Additional discussion of the pre-development Site geology is presented in Section 2.3.2.

2.6.2 Historical Site Use and Operations

The Site is one of the Port of Seattle's earliest operating commercial terminals (Pinnacle Geosciences 2003). Its origins and commercial use date back to the original filling of the intertidal lands. The Site was initially constructed by dredging and filling activities in the early 1900s, when the Duwamish River was reconfigured to the current channel location. In addition to sediment fill placement at the Site, other upland fill materials (associated with the regrading of Beacon Hill and Denny Hill) were placed. From 1915 to approximately 1930, the Site was used for cold storage, logging facilities, and as a sawmill. By 1930, the mill operations were expanded. The mill site was removed to allow for lumber storage and automobile staging in the early 1960s. Additional automobile undercoating facilities were constructed in the 1970s. The current terminal area north of the Site was a turning basin until 1972, when it was filled in. The Site was acquired by the Port in the late 1970s. During the 1980s, the Site was used for cold storage, seafood processing, and shipping operations. Most structures and buildings were demolished at the Site in the 1990s, with the cold storage building demolished in the early 2000s. Historical operations are depicted in Figure 2-5.

2.6.3 Current Site Use and Operations

The Site is paved or covered with compacted gravel. It is graded to drain stormwater to a collection system consisting of catch basins. Collected stormwater is discharged to the EW through outfall locations on the west end of the Site. The current stormwater drainage network for the Site is further detailed in Section 2.12.4.

The Site is bounded to the east by Northwest Seaport Alliance property adjacent to East Marginal Way, to the south by Spokane Street, to the west by the EW, and to the north by the active terminal facility (Figure 2-1). A piling field is present within the sediment area adjacent to most of the western and all of the north shoreline areas. The deck was removed from this structure in 2006 by the Port, and the area is currently not in use. No vessel moorage activities occur within the Site.

The Port currently leases the upland portions of the Site to various tenants who use the area for equipment and material laydown, light industrial activity, and truck parking. The southeastern portion of the Site includes the City of Seattle's (City's) right of way and is used as a paved, active construction laydown area. The southeast portion of the Site is paved with asphalt and is used as a parking area for trucks. The western portion of the Site contains paved and unpaved portions and abuts the eastern shoreline of the EW. The southwestern portion of the Site is used as a log and woody debris storage area. The northern portions of the Site upland area are currently unused. Current Site use areas and features are depicted in Figure 2-1.

Fish are known to be present and support commercial, recreational, and tribal fisheries. The EW is within the usual and accustomed fishing area for the Muckleshoot Indian Tribe and the Suquamish Tribe.

2.6.4 Future Site Use

The Site is intended to be the location of a habitat restoration project conducted by the Port, which would restore intertidal and shallow subtidal habitat by removing contaminated sediments from the EW OU and contaminated soil from the adjacent upland to create off-channel emergent marsh and riparian habitat. The habitat restoration also includes restoration of a riparian buffer along the new southern and eastern shorelines and a stormwater feature to the east (Figure 1-3).

2.6.5 Adjacent Property Use and Operations

Use and operations on adjacent properties outside of the Site boundary are discussed in the subsections below and depicted in Figure 2-6.

2.6.5.1 Terminal 25

The northern portion of the terminal north of the Site is owned by the Port and currently leased by Stevedoring Services of America (SSA Marine). SSA Marine uses this portion of the Site as a container terminal and has an Industrial Stormwater General Permit for Site operations. Site operations include container storage and berthing of container vessels at the terminal. Level 1 and 2 corrective actions completed in 2021 at the northern portion of the terminal due to copper and zinc benchmark exceedances in stormwater included installation of stormwater treatment systems.

2.6.5.2 Hinds Outfall

The South Hinds Street outfall (outfall number 107) is just north of the northern border of the Site (Figure 2-6). It is a separated storm drain and combined sewer service system (CSO) owned and operated by the City of Seattle. It is the smallest CSO basin (56 acres) of the three CSOs located in the EW. Discharge is regulated under a National Pollutant Discharge Elimination System permit with Ecology (Permit WA0031682), which requires regular monitoring and reporting. The City is currently implementing CSO control activities under a Consent Decree with EPA, Department of Justice, and Ecology to reduce sewer overflow events. Seattle Public Utilities (SPU) completed the EW Sewer System Improvement Project in August 2017, fulfilling permit and Consent Decree requirements to complete construction of sewer system improvements by the end of 2020, which is intended to meet the City's requirement for no more than one CSO discharge per year on average. As part of source control efforts for EW, SPU has conducted source tracing activities within the drainage area for this outfall, including cleaning the combined sewer lines along S Hinds Street and East Marginal Way S (2,900 feet) and cleaning the entire storm drain line. SPU continues to conduct monitoring and maintenance activities for source control purposes.

2.6.5.3 City of Seattle Right of Way

Along the southeastern boundary of the Site is the City right of way. This location was the site of the Bent 97 investigation, which is detailed in Section 2.9.2. This portion of the Site is paved and currently used as an active construction laydown area.

2.6.5.4 Additional Adjacent Site Uses

Additional Site uses adjacent to the Site include the following:

- Olympic Tug and Barge moors vessels to the west of the Site within the EW OU.
- The Spokane Street fishing pier is open to the public and runs along the south side of the Site.
- A public bike path runs along E Marginal Way S and S Spokane Street adjacent to the Site.

2.7 Terminal 25 Site Investigations

Environmental investigations of soil, intertidal bank sediment, groundwater and stormwater have been conducted at the Site for various purposes beginning in the late 1960s, as follows.

2.7.1 Shannon & Wilson, Inc, 1968

Fifteen soil borings were drilled to depths ranging from 30 to 60 feet to perform standard penetration resistance, grain size classification, triaxial compression test, mohr strength envelope, and consolidation test. Subsurface soil condition summarized in this report will be referenced for the geotechnical evaluation of the proposed habitat restoration activities.

2.7.2 Blymyer Engineers, Inc., 1989

A Phase 1 Environmental Site Assessment (ESA) was performed on behalf of Matson Terminals, Inc. (a previous tenant), by Blymyer Engineers, Inc. (BEI; 1989), and included historical research and completion of a series of soil explorations. Boring locations were selected based on historical research of past Site uses. Twelve soil borings (B-1 through B-12; Figure 2-7) were drilled approximately 10 feet bgs and analyzed for one or more of the following analyses: total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs). Two locations exceeded applicable soil criteria. TPH-diesel and TPH-oil and grease exceeded soil criteria at B-12 and polycyclic aromatic hydrocarbons (PAHs; naphthalene, acenaphthene, fluorene, phenanthrene, anthracene, 2-methylnaphthalene) at B-10. As reviewed in Landau and EcoChem (1990) the field collection and analytical methods used in this study may have overestimated TPH at Boring B-12. The analytical method used for these data (EPA 503E/418.1) may not have used a silica gel cleanup, which can result in a high biased concentration due to organic material in the soil. Additionally, the degree to which the field team homogenized the sample interval is unclear.

2.7.3 Sweet-Edwards/EMCON, Inc., 1990

Sweet-Edwards/EMCON, Inc. (1990), prepared a Subsurface Investigation Report to document the excavation and removal of a 3,000-gallon gasoline underground storage tank from the southwestern portion of the Site in 1989. Soil samples were collected from the excavation area, and four groundwater monitoring wells were installed. Soil and groundwater samples were analyzed for petroleum-related benzene, toluene, ethylbenzene, and xylene (BTEX) and TPH compounds. Post-excavation soil and groundwater samples were below MTCA criteria. The groundwater monitoring wells installed during this investigation were decommissioned and are no longer present on the Site. In 2012, the Site received a No Further Action determination by Ecology establishing that no further remedial action was necessary at the Site to clean up contamination associated with leaking underground storage tank (LUST) ID 1591 (Ecology 2012).

2.7.4 Landau Associates, Inc. and EcoChem, Inc., 1990

A soil and groundwater investigation was performed near the location of a former maintenance building in the southwestern portion of the Site to characterize the chemical nature of soil and groundwater in the vicinity of BEI's Phase 1 ESA boring location B-12 (Landau and EcoChem 1990). Three borings were drilled, and groundwater monitoring wells were installed in the vicinity of B-12 to assess potential TPH impacts in nearshore soil and groundwater. Three soil samples were submitted for analysis of TPH based upon field screening methods indicating potential presence of contamination. Groundwater samples collected from each well were submitted for analysis of TPH. While low levels of TPH (20 to 95 parts per million) were measured in subsurface soil, concentrations were not detected in groundwater samples. The soil and groundwater concentrations did not trigger reporting to Ecology. The groundwater monitoring wells were decommissioned and are no longer present on the Site.

2.7.5 Pinnacle Geosciences, Inc., 2003

Pinnacle Geosciences, Inc., completed a Phase 1 ESA at the Site for the Port in September 2003 (Pinnacle Geosciences 2003). The Phase 1 ESA provides an inventory and overview of potential environmental considerations related to soil and groundwater contamination that could affect future redevelopment of the Site. The Phase 1 ESA at the Site includes summaries of environmental investigations completed at the Site through 2003 and identifies "Recognized Environmental Conditions" based on research and results of those investigations. Key historical structures and operations within the Site project boundary include the compressor building, vehicle and equipment maintenance building, automobile preparation facility, two sawmills, and an underground storage tank (UST). Possible contamination from historical structures and operations at the Site include TPH, solvents (petroleum-based or chlorinated), polychlorinated biphenyls (PCBs), metals, and paint.

2.7.6 Shannon and Wilson, 2008

One exploratory soil boring was drilled to a depth of 81.5 feet to perform geotechnical engineering analyses regarding the installation of new light poles at the Site (Shannon and Wilson 2008). While no chemical analysis was conducted on the soil, the subsurface soil conditions summarized in this study will be incorporated into the geotechnical evaluation of the proposed habitat restoration activities.

2.7.7 Anchor QEA and Aspect, 2012

A Site investigation was conducted at the Site to evaluate potential contaminant migration pathways from the upland to the EW OU (Anchor QEA and Aspect 2012). Samples of nearshore groundwater and intertidal bank sediments were collected and analyzed for COPCs including metals, SVOCs, PAHs, and PCBs. Four shallow groundwater wells (AQ-MW-1 through AQ-MW-4; Figure 2-7) were installed at approximately 13 to 14.5 feet bgs along the nearshore portion of the Site to assess the quality of groundwater discharging from the Site to the EW. Concentrations of COPCs in groundwater were below the established EW reference values and marine ambient Water Quality Criteria (WQC) except for acenaphthene and bis(2-ethylhexyl) phthalate in two samples. Two intertidal bank composite sediment samples were collected to assess surface sediment quality in the upper intertidal area of the Site. Exceedances of Washington State Sediment Management Standards (SMS) criteria in one sample include pentachlorophenol and PAHs, which were attributed to the existing creosote treated lumber piles adjacent to the sampling area.

2.7.8 Anchor QEA, 2019–2020

In-water sediment and upland soil investigations were conducted in 2019 and 2020 at the Site under the existing EW SRI/FS ASAOC to support planning and design of the Site habitat restoration project and implementation of the EW remedial alternative that will be selected by EPA in the ROD. Sample locations from these investigations are included in Figure 2-7. These in-water sediment and upland soil samples were collected in accordance with the EPA approved Quality Assurance Project Plan (QAPP; Anchor QEA and Windward 2019b). Data are presented in the *Soil and Subsurface Sediment Characterization Data Report* (Anchor QEA 2021a) and are summarized as follows:

- 2019 Upland Sampling: Soil borings were collected at 15 locations in January 2019. Samples were composited from material in the anticipated habitat restoration excavation intervals and tested for waste characterization parameters, including toxicity characteristic leaching procedure (TCLP). Samples were also collected from post-excavation surface material, which represents the expected exposed surface after the proposed restoration project excavation, and analyzed for Site COPCs, including metals, PAHs, SVOCs, PCBs, and dioxins/furans (D/F). Samples for geotechnical analyses were also collected to support subsequent phases of design.

- 2020 Supplemental Upland Sampling: Eleven borings were collected in upland locations to characterize the lateral and vertical extent of PCB contamination encountered during the 2019 upland sampling event and for additional waste characterization of the restoration project excavation material.
  - Restoration Project Excavation Intervals: Material anticipated to be excavated to support the restoration were tested for TCLP metals, SVOCs, PAHs, PCB Aroclors, and TPH (diesel and motor oil range). Appendix A, Attachment A-3 presents results that are screened against RCRA disposal criteria, and the PCB remediation waste threshold of 50,000 micrograms per kilogram (µg/kg) in the TSCA. These data will inform excavation best management practices and options for soil management and disposal. No TCLP metals concentrations exceeded RCRA thresholds. No SVOC or TPH concentrations exceeded RCRA criteria within these restoration excavation intervals. No PCB concentrations in restoration excavation intervals (composite samples) exceeded the TSCA PCB remediation waste threshold of 50,000 µg/kg. The restoration project excavation interval at T25-SB16 (0 to 10 feet bgs), the location where the oil/water separator was installed, was also tested for TCLP metals, SVOCs, PAHs, PCBs, and TPH. No TCLP metals concentrations exceeded RCRA thresholds. No SVOC, PAH, PCB or TPH concentrations exceeded RCRA criteria at this location. The total PCB concentration was well below 50,000 µg/kg.
  - Anticipated Post-Excavation Surface Intervals: Anticipated post-excavation surface sample results were below the SMS Sediment Cleanup Objectives (SCO) and cleanup screening level (CSL) at seven boring locations. The remaining location results exceeded the SMS SCO or CSL for SVOCs, PAHs, PCBs, or D/F. Archived intervals below the post-excavation surface intervals were triggered for additional analyses at three locations due to PAH or PCB concentrations above SCO, CSL, or TSCA criteria. The vertical extent of contamination was delineated at these locations.
  - Post-Excavation Substrate: Planned project elevation changes and cross sections are shown in the Data Report (Anchor QEA 2021a). The cross sections depict the existing grade, proposed grade following restoration, proposed subgrade following over-excavation to support placement of final habitat material (equivalent to the post-excavation surface), approximate thickness of wood debris, and the native sediment elevation based on boring and sediment core observations. The native contact ranged from -3.6 feet MLLW to +1.7 feet MLLW in the design area. The native elevation was fairly consistent across all borings and

significantly below the proposed subgrade surface. Wood debris was observed at various depths in 15 boring locations.

- Upland PCB Delineation: Supplemental soil borings were collected in August 2020 to characterize the lateral and vertical extent of PCB concentrations exceeding the TSCA PCB remediation waste threshold of 50,000 µg/kg encountered during the first phase of the investigation at boring location T25-SB03, adjacent to the approximate UST removal location. Ten step-out borings were collected at eight locations in the surrounding area. PCB concentrations were below the TSCA remediation level to the north, west, and south of T25-SB03. PCB concentrations in subsurface soil at two locations east of T25-SB03 exceeded the TSCA PCB remediation waste threshold.

- 2019 In-Water Sampling: Sediment cores were collected from nine nearshore locations in and around the piling field in March 2019 in accordance with the EPA-approved QAPP (Anchor QEA 2019b) to support planning for habitat restoration. Cores were collected to characterize the planned dredge prism, the post-dredge (Z-layer) surface, and the nature and extent of contamination using a floating vibracore unit that could access coring locations without significant piling removal activities. Due to substantial debris encountered, several locations were offset from the target locations; two were collected outside of the project area and one had refusal after recovery of 2 feet of material (SC01; sample was archived). Results were compared to SMS and EW RALs, and three samples were screened for waste disposal. Because the sediment portion of the Site is part of the EW OU, it was presumed that the top 4 to 5 feet of the dredge prism was contaminated and would be sent to an upland landfill once removed. Sediment intervals were analyzed based on coordination with EPA to map the vertical extent of contamination.
  - Dredge Intervals: The upper intervals of material planned to be dredged above the preliminary habitat restoration elevation from three core locations were tested for TCLP metals, SVOCs, PAHs, and PCB Aroclors and two of the locations were tested for TPH. No results were above RCRA criteria.
  - Post-Dredge Surface Intervals: Sufficient penetration to collect Z-layer samples to provide information on post-dredge surface concentrations following habitat restoration was achieved at three coring locations; SC02, SC03, and SC04.
    - SC02 slightly exceeded the SMS SCO for acenaphthene; however, no further testing was required on deeper intervals at that location.
    - SC03 exceeded the SMS CSL for 2,4-dimethylphenol and several PAHs; and the SMS SCO for total PCBs. The two intervals below the Z-layer were subsequently tested and concentrations decreased with depth. The interval directly below the upper Z-layer sample exceeded the AET SCO for fluoranthene and total PCBs; and the Apparent Effects Threshold (AET) CSL

for phenanthrene. There were no exceedances in the bottom Z-layer sample (4.7- to 6.2-foot interval), indicating the vertical extent of contamination at this location has been bounded.

- SC04 exceeded the SMS CSL for mercury and total PCBs, the SMS SCO for 1,2,4-trichlorobenzene, and exceeded the EW RAL for D/F toxic equivalents quotient (TEQ). The two intervals below the Z-layer were subsequently tested and exceeded either the SCO or CSL for several PAHs and PCBs and exceeded the D/F EW RAL. Concentrations decreased with depth, but no additional intervals were available to verify the bottom of contamination.
- Penetration at the remaining locations was not sufficient to reach the design subgrade elevation (SC01, SC05, SC06, SC07, SC08, SC09B), but samples were submitted for chemistry analysis to characterize nature and extent (SC01 samples were shallow and archived). Samples at various depths from each location exceeded the SMS SCO or CSL for PCBs, PAHs, mercury, chlorinated benzenes, or 2,4-dimethylphenol. In addition, the EW RAL was exceeded at four locations.

2.7.9 Anchor QEA, 2021

Nineteen additional subsurface sediment cores were collected throughout the subtidal areas of the planned habitat restoration footprint in December 2021 in accordance with the EPA approved QAPP Addendum 2 (Anchor QEA 2021b). Samples were collected to support delineation of the vertical extent of contamination and dredge design evaluations for the future habitat restoration. Twenty locations were planned but one was abandoned due to the presence of shallow rock or other hard material encountered. All samples were analyzed for total solids, total organic carbon, metals, SVOCs, PAHs, total PCB Aroclors and D/F and select samples were analyzed for tributyltin (TBT) and pesticides. Results from the 19 locations bounded vertical contamination at 15 of the core locations. Vertical contamination has not been bounded as the following locations: SC16, SC20, SC22 and SC23 (SC23 is currently undergoing additional testing of deeper archive samples). Contaminated thickness with sediments exceeding SMS SCO ranges from 5.3 to 11.3 feet below mudline, except for three locations that were below SMS criteria: SC10, SC19 and SC24. SMS SCO or CSL values were exceeded at the remaining locations at various depths for metals, PAHs, SVOCs, or PCBs. In addition, samples from eight locations exceeded the EW RAL for D/F TEQ.

2.8 Prior Remedial Actions at the Site

Historical industrial operations have resulted in the placement or release of potentially contaminated materials in the upland areas of the Site.

Prior remedial actions conducted at the Site include the following:

- Sweet-Edwards/EMCON, Inc. removed a LUST in 1989 (Figure 2-5). Post-excavation and tank removal soil and groundwater samples indicated no exceedances of MTCA soil or groundwater criteria. As discussed in Section 2.7, Ecology issued a No Further Action following the LUST removal and confirmatory sampling.

2.9 Investigations on Adjacent Properties

Properties adjacent to the Site are included in Figure 2-6. Investigations conducted at these properties is summarized in the following subsections.

2.9.1 Harbor Island Superfund Site: East Waterway Operable Unit

The Harbor Island, including the EW OU, was added to the National Priorities List in 1983. EPA is overseeing cleanup studies in the EW under an existing ASAOC with the Port (EPA Docket No. CERCLA-10-2007-0030), including completion of the SRI/FS. The SRI was approved by EPA in 2014 (Windward and Anchor QEA 2014), which included the baseline ERA, baseline HHRA, and assembled data to identify the nature and extent of contamination in the EW, evaluate sediment transport processes, and identify potential sources and pathways of contamination to the EW. The FS was approved by EPA in 2019 and develops and evaluates EW-wide remedial alternatives to address risks posed by COCs within the EW. EPA has indicated it intends to release a Proposed Plan in 2022 that recommends a preferred remedy and cleanup plan for the EW. After public, state, and tribal comments on the Proposed Plan, EPA will select the final remedial alternative in the ROD.

2.9.2 Bent 97 Investigation

Herrera conducted a partial cleanup of localized PCB-contaminated soil at the Bent 97 location in the City's right of way along the southern border of the Site in 2010. The location was adjacent to the site of the former Westinghouse laboratory building, which was present between the 1940s and 1960s. The City removed contaminated soils from the area, however confirmation testing identified remaining PCB contamination in the soil following removal (Herrera 2010). The Port conducted additional characterization of this PCB area in 2011 and 2012, which was not determined to be a source of upland contamination to EW sediments (Anchor QEA and Aspect 2012) as discussed in Section 2.7.

2.9.3 East Marginal Way South at South Horton Street; East Marginal Way South Bridge Rehabilitation

The bridge reconstruction project at East Marginal Way South and South Horton Street identified contaminants in soil exceeding MTCA Method A and B cleanup levels, including arsenic, carcinogenic PAHs, benzene and D/F TEQ in 2011 (Ecology 2022a). After contamination was identified, the site was added to Ecology's Confirmed and Suspected Contaminated Sites List. The site is currently awaiting cleanup and is monitored by Ecology as Cleanup Site ID 12027.

2.9.4 3400 East Marginal Way South; BEI Chempro Field Services

BEI Chempro Field Services was listed as a cleanup site by Ecology due to halogenated organics that were suspected in soil. Contamination at the site was officially noted in 1988 and the site was given a No Further Action status in 1995 by Ecology based on the completion of cleanup actions that occurred prior to MTCA becoming law (Ecology 2022b).

2.10 Database Development

This section provides an overview of the assessment conducted on available Site soil, groundwater, and sediment data to determine if these data are acceptable for use in the streamlined risk assessment and EE/CA.

2.10.1 Compilation of Data

Existing Site data (including soil, groundwater, and sediment data) were assessed to determine their acceptability for use in the EE/CA. All data that met the data quality requirements were imported into an Environmental Quality Information System database for the EE/CA. Data that did not meet the acceptability criteria for the EE/CA were copied into Microsoft Excel for use in the development of the preliminary CSM and evaluation of data gaps (Appendix A-2).

2.10.2 Data Quality Assessment

A preliminary assessment of the compiled dataset was conducted to evaluate data useability for the EE/CA. The assessment was based on minimum data acceptability criteria and the following relevant guidance:

- EPA (1988) Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA
- EPA (1992) Guidance for Data Useability in Risk Assessment, Part A
- EPA Contract Laboratory Program Functional Guidelines for Data Review (variable dates for different analyte groups)
- EPA (2009) Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use

A summary of the data quality assessment for existing Site soil, groundwater, and sediment investigations is presented in Table 2-1. The following criteria were used in the assessment:

Work Plan Documentation:

- Documentation describing the sampling program or event, the methods used, and the parties involved in sample collection must be available.
- Collection methods must be clearly defined and be adequate for obtaining representative and quantitative information.
- The purpose of data collection should be documented.

Sample Location and Collection Methods:

- Sample coordinates and a qualitative understanding of accuracy (i.e., knowledge of how the location was established or the method by which the coordinates were obtained) must be documented. The coordinate system must be documented.
- Sample collection method and must be documented. For example, a water sample must be identified as to whether it is a surface water, porewater, or groundwater sample and whether it is whole water or filtered (i.e., total versus dissolved fraction). Temporal or spatial compositing and sample volume must be identified.
- Sample depths and, where applicable, start and end depths must be identified.
- Sample storage methods must be documented and consistent with approved methods, including holding time and preservation.
- Sample chain of custody must be documented.

Laboratory Analysis:

- Data tables are available (not in summary format) with laboratory reports and data validation information.
- Appropriate detection limits and quantitation limits are achieved so that the data meet DQOs for environmental investigations:
  - Detection limits, units for each detection limit, and data qualifiers must be reported. Non-detected results must have the associated detection or reporting limits indicated. Data qualifiers must follow EPA guidance or be defined in documentation.
  - Analytical methods must be documented and acceptable based on EPA guidance.
  - Measurement instruments and calibration procedures must be documented.
  - Collection methods, sample preservation, and sample preparation methods must be documented.

QC and Data Validation:

- Documentation of field and laboratory QC samples (duplicates and blanks) must be present.
- Analytical chemical data must have been validated and qualified consistent with EPA functional guidelines or EPA Region 10 validation practices.

- Hard copies of laboratory data reports (e.g., Form 1 or Certificates of Analysis) must be available to verify that electronic or tabulated data were accurately transcribed or transmitted.

In addition to these criteria, the data were evaluated based on age. Groundwater data collected more than 10 years ago may not be representative of current Site conditions. Improvements to analytical methods over time have also resulted in better detection limits.

Following the data quality assessment, the data were assigned a data quality (DQ) classification as either DQ-1 or DQ-2, as follows:

1. DQ-1 results generally met the work plan documentation, sample location and collection, methods, laboratory analysis QC and validation requirements, and age. These data are acceptable for use in the streamlined risk assessment and EE/CA cost estimate evaluations.
2. DQ-2 results do not meet these requirements.

DQ-2 data are useful for the development of the preliminary CSM (Section 3.3) and data gaps evaluation (Section 5) presented in this EE/CA Work Plan but are not useful for the streamlined risk assessment or EE/CA. These data will need to be replaced or supplemented for the purpose of the EE/CA. Most of the historical data collected before 2011 was assigned as DQ-2 (Table 2-1).

2.10.3 Development of Screening Levels

Sediment screening levels (SLs) were developed for the Site using established EW RALs, Washington SMS, and Lower Duwamish River Natural Resource Damage Assessment (NRDA) Trustee Injury Thresholds for sediment, as further described in Section 2.10.3.1. These SLs were used to screen Site data, including existing EW sediment samples and sediments created through the Site habitat restoration (i.e., Future Sediment Area soil samples) within the Site (Figure 1-3). These SLs were used to determine the data gaps (Section 5) that need to be filled to complete the EE/CA. The development of SLs is based on preliminary exposure pathways and receptors, discussed further in Section 3.1.1, as well as Applicable or Relevant and Appropriate Requirements (ARARs), discussed further in Section 4.4.1. In the EE/CA report, the SLs will be adjusted based on the highest of the applicable SL, background concentration (i.e., natural, anthropogenic, or site-specific), or practical quantitation limit, in consultation with EPA. The following subsection describes the SL development for the EW Sediment Area and Future Sediment Area of the Site (Figure 1-3), which are presented in Table 2-2.

For the Future Modified Upland Area (Figure 1-3), Soil and Groundwater Recontamination SLs will be developed as part of the EE/CA and based on LDW Preliminary Cleanup Levels for the protection of surface water and sediment via the groundwater pathway (Ecology 2022c). Recontamination SLs will be used to identify COPCs in the Future Modified Upland Area that may impact surface water, sediments, or organisms in the EW and Future Sediment Area.

2.10.3.1 Preliminary Screening Levels for Existing East Waterway Sediment Area and Future Sediment Area

The Site includes the existing EW Sediment Area and soil that will be excavated to create intertidal and marsh areas, termed the Future Sediment Area (Figure 1-3). As such, sediment-based criteria are applicable to both the existing EW Sediment Area and the Future Sediment Area and were used for screening. The Sediment SLs were selected as the lowest criteria from the following sources:

- EW RALs (Anchor QEA and Windward 2019a): EW RALs are contaminant-specific sediment concentrations that trigger the need for remediation (e.g., dredging, capping, or monitored natural recovery). The RALs are designed to achieve RAOs for the EW and are developed for three of four human health risk drivers (total PCBs, arsenic, and D/F) as well as a subset of the ecological risk drivers,[1] which include TBT and a set of indicator SMS chemicals (i.e., selected risk driver contaminants detected above the SCO in surface sediments that represent the extent of all SCO exceedances).
- Washington State SMS Marine SCO (Ecology 2021): The SMS contain numerical sediment contaminant concentration criteria for the protection of the benthic community developed using the AET approach. The SCO values are the lowest AET for each chemical and are concentrations that Ecology has determined will have no adverse effects on the benthic community. Organic carbon-normalized (OC-normalized) criteria are available for non-polar organics and should be used for samples where total organic carbon (TOC) is between 0.5% and 3.5%. Dry-weight values are used for metals and polar organics. Dry-weight values are also available for non-polar organics when the sample TOC is outside of the 0.5% to 3.5% range.
- Lower Duwamish River NRDA Trustee Injury Thresholds (Injury Thresholds; NOAA 2013): The Injury Thresholds are dry-weight sediment contaminant concentrations based on the concept of ecological service loss. Ecological services are lost when organisms are adversely impacted by either non-lethal or lethal effects. The Injury Threshold (i.e., initial injury level) is defined as relatively insignificant and for most chemicals is estimated as 5% of the ecological service value for any form of marine habitat, which in some cases is below SMS SCO. Injury Thresholds for total PAHs, Total PCBs, and dichlorodiphenyltrichloroethane (DDT) and metabolites are derived differently as described below.
  - For total PAHs, the Injury Threshold is 1,000 µg/kg, which is based on effects observed in English sole in the Puget Sound. At this sediment concentration, nearly 5% of adult

[1] Total PCBs were also identified as an ecological risk driver for fish. The total PCB PRG for human health is lower than the fish PRG, so the remediation area developed in consideration of human health will address risks for fish.

females are infertile when compared to reference populations, and toxicopathic lesions are observed in nearly 10% of English sole.

- For Total PCBs, the Injury Threshold of 128 µg/kg dry weight (dw) corresponds to the SMS SCO (130 µg/kg) but is derived from the source (Meador et al. 2002) using an area weighted average TOC value for the Duwamish River.
- For dichlorodiphenyldichloroethane (DDD), dichlorodiphenyldichloroethylene (DDE), and DDT, the Injury Thresholds are based on the initial level of adverse effects observed in the State of Washington AETs.

2.11 East Waterway Site Data

As discussed in Section 2.2.3, sediment remediation in the EW will be addressed under the EW Superfund Site ROD. For the purposes of the EE/CA, sediment data from the EW OU within the Site are evaluated with recent sediment and soil data collected as part of the Site investigations to inform development of the preliminary CSM, assess human health and ecological risks, and identify data gaps for the EE/CA and habitat restoration design.

Ultimately, the EW RALs that were developed in the Final FS (Anchor QEA and Windward 2019a) will form the basis for establishing sediment concentrations at the Site protective of human health and the environment.

2.12 Nature and Extent of Contamination

This section summarizes the available analytical data for the Site by media, screens it against applicable Sediment SLs, and presents the spatial distribution of chemicals at the Site. Based on historical operations described in Section 2.6, evaluation of the existing data described in Section 2.7, and consistency with the EW FS (Anchor QEA and Windward 2019a) metals, TBT, SVOCs, PAHs, PCBs, and D/F are the preliminary COPCs.

2.12.1 Soil

The available soil data for the upland portion of the Site are screened against the applicable Sediment SLs. The upland portion of the Site comprises the Future Sediment Area and Future Modified Upland Area (Figure 1-3). Because the Future Sediment Area will be excavated for the construction of the marsh, sediment-based criteria are applicable to the soil data in these areas. One boring (SB11) is located along the boundary of the Future Sediment Area and the Future Riparian Buffer and was considered to be part of the Future Sediment Area. The Sediment SLs are presented in Table 2-2.

Samples from the Future Modified Upland Area are also screened against the Sediment SLs provided in Table 2-2. However, only two soil borings (SB12 and SB13) are present in the Future Modified Upland Area (in the proposed stormwater feature that will be excavated during construction). As described in Section 2.10.3, for the Future Modified Upland Area, Soil and Groundwater Recontamination SLs will be developed as part of the EE/CA for the protection of surface water and sediment via the groundwater pathway (Ecology 2022c).

2.12.1.1 Future Sediment Area

In 2019 and 2020, soil borings were collected from 16 locations within the Future Sediment Area (Figure 2-7). Samples were collected from material planned for removal to support habitat restoration construction (excavation interval) and the planned post-excavation surface material following habitat restoration construction (planned post-excavation intervals). Because the material within the excavation interval will be removed during construction, only the samples collected from the post-excavation surface material and below were included in the screening.

The existing soil data collected from within the Future Sediment Area data are summarized in Table 2-3. Chemical concentrations in all samples were compared to the Sediment SLs to determine the number of samples that exceeded the SL and, if a chemical exceeded its respective SL, the maximum exceedance factor was calculated (Table 2-3). For chemicals that were not detected, the reporting limit, or method detection limit for high resolution methods, were compared to the Sediment SLs. Four SVOCs, 4-methylphenol, benzoic acid, benzyl alcohol, and diethyl phthalate each exceeded the SL in one sample. Fluoranthene, phenanthrene, total PAHs, total PCB Aroclors, and D/F TEQ also exceeded their respective SLs (Figure 2-8). Several contaminants were identified above Sediment SLs that were not already identified as Risk Driver COCs for the EW SRI/FS, including 4-methylphenol, benzoic acid, benzyl alcohol, diethyl phthalate and total PAHs.

The VOC 4-isopropyltoluene was detected in two locations (SB07 and SB09) where VOC testing occurred as a result of photoionization detector elevated readings. A Sediment SL has not been identified for this contaminant, but 4-isopropyltoluene was further evaluated due to historical operations at the former sawmill and former automobile preparation facility where paint and paint solvent contamination is possible. The maximum detected concentration is 72,900 µg/kg, which is 300 times higher than the EPA Region 4 Sediment Ecological Refinement Screening Value of 242 µg/kg based on an Ecological Structure Activity Relationship (ECOSAR) model minimum chronic value (EPA 2018). At both locations for which 4-isopropyltoluene was detected, concentrations decrease significantly with depth to 2.78 µg/kg for SB07 at 16 feet bgs and 1.22 µg/kg for SB09 at 15 feet bgs.

Soil samples in the planned post-excavation intervals were also compared to the TSCA PCB remediation waste threshold of 50,000 µg/kg. Total PCB concentrations were below 50,000 µg/kg at all boring locations, with the exception of three borings (Figure 2-9), as follows:

- T25-SB03: Total PCB concentration in the 7.5- to 9.5-foot interval exceeded 50,000 µg/kg. PCB concentrations in the sample intervals above and below were below 50,000 µg/kg.

- T25-SB03E: Total PCB concentrations in the 8- to 9-foot interval and 9- to 10-foot interval exceeded 50,000 µg/kg. PCB concentrations in the sample intervals above (7 to 8 feet) and below (10 to 11 feet) were both below 50,000 µg/kg.
- T25-SB03F: Total PCB concentrations in the 9- to 10-foot interval exceeded 50,000 µg/kg. PCB concentrations in the sample intervals above (7 to 8 feet and 8 to 9 feet) and below (10 to 11 feet) were below 50,000 µg/kg.

2.12.1.2 Future Modified Upland Area

The Future Modified Upland Area consists of a riparian buffer to the south and east and a stormwater feature to the east. Two soil borings (SB12 and SB13) were located in the stormwater feature area, but only the surface soils were tested, and because stormwater feature construction will result in excavation in this area, samples from these borings are not considered to be representative of future conditions.

SB11 is located on the boundary of the riparian buffer and the Future Sediment Area on the south end of the Site and was included in the Future Sediment Area evaluation (Section 2.12.1.1). Boring SB11 contains elevated concentrations of PCBs and D/F that exceed the Sediment SLs. As discussed in Section 5.2, additional data will be collected to support evaluation of recontamination of the habitat restoration area along the upland boundaries of the Site.

2.12.1.3 Summary of Soil Nature and Extent

Figure 2-10 depicts all locations and elevations where planned post-excavation soil data exceed a sediment SL for any analyte. At least one sample collected from 13 of the 18 sediment borings exceeded a sediment SL for 4-methylphenol, benzoic acid, benzyl alcohol, diethyl phthalate, fluoranthene, phenanthrene, total PAHs, D/F TEQ, or total PCB Aroclors. Borings SB01, SB04B, SB05, SB10, and SB13 did not contain samples with elevated concentrations of any analyte in any planned post-excavation interval. Borings SB10 and SB04B are located along the southern boundary of the Site and boring SB01 and SB05 are the northernmost borings within the Future Sediment Area.

To evaluate the vertical extent of contamination based on the existing data, Figure 2-11 depicts the maximum depth of contamination for COPCs and identifies locations where SL exceedances are bounded by a deeper sample that does not exceed the SL. The vertical extent of contamination was fully delineated in seven borings (SB01, SB02, SB04B, SB05, SB09, SB10, and SB13). At each of these locations, analyte concentrations within the deepest sample interval collected below the ground surface did not exceed any Sediment SLs, suggesting that the vertical extent of contamination in these areas has been fully delineated.

2.12.2 Sediment

The sediment data collected in the Existing Sediment Area of the EW OU are summarized in Table 2-4. Sediment samples include surface sediment grabs and sediment cores collected as part of the EW SRI and sediment cores collected as part of recent Site investigations. In total, data from 34 subsurface sediment cores and 10 surface sediment grabs in the Existing Sediment Area were evaluated. Chemical concentrations in all samples were compared to the Sediment SLs to determine the number of samples that exceeded the SL and, if a chemical exceeded its respective SL, the maximum exceedance factor was calculated (Table 2-4). For chemicals that were not detected, the reporting limit, or detection limit for high resolution methods, were compared to the Sediment SLs. The following 39 chemicals exceed their respective Sediment SLs:

- Cadmium
- Chromium
- Lead
- Mercury
- Silver
- Zinc
- Tributyltin
- 1,2,4-Trichlorobenzene
- 1,4-Dichlorobenzene
- 2,4-Dimethylphenol
- 4-Methylphenol
- Bis(2-ethylhexyl)phthalate
- Butylbenzyl phthalate
- Di-n-octyl phthalate
- n-Nitrosodiphenylamine
- Pentachlorophenol
- Phenol
- 2-Methylnaphthalene
- Acenaphthene
- Anthracene
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b,j,k)fluoranthenes
- Benzo(g,h,i)perylene
- Chrysene
- Dibenzo(a,h)anthracene
- Dibenzofuran

- Fluoranthene
- Fluorene
- Indeno(1,2,3-c,d)pyrene
- Naphthalene
- Phenanthrene
- Pyrene
- Total Benzofluoranthenes (b,j,k)
- Total high-molecular weight PAH
- Total low-molecular weight PAH
- Total PAHs
- Total D/F
- Total PCB Aroclors

Several contaminants were identified above Sediment SLs that were not previously identified as COCs for the EW SRI/FS, including chromium, lead, silver, 1,2,4-trichlorobenzene, 4-methylphenol, di-n-octylphthalate, pentachlorophenol, naphthalene and total PAHs. Sediment SLs for chromium, lead, silver, 4-methylphenol, and total PAHs are based on Injury Thresholds that are below SMS SCOs.

Figure 2-12 depicts all locations and elevations where sediment data exceed a sediment SL for any analyte. All but one of the surface grab locations exceed a sediment SL and 31 of the 34 sediment cores exceed a SL in at least one sample interval. In most cores, chemical concentrations decrease with increasing depth below the mudline, with the maximum depth of contamination ranging from 5.1 to 10 feet.

In the Existing Sediment Area and along the north and west boundaries, the vertical extent of contamination was fully delineated at 19 out of 25 sediment core locations outside of the piling field (Figure 2-13). At each of these locations, the deepest available sediment core interval did not exceed a Sediment SL for any COPC. For 2 of the 6 locations with exceedances in the deepest interval, the only exceedance was for total PAHs. The Sediment SL is based on an Injury Threshold of 1,000 µg/kg which is significantly more conservative than SMS Marine SCO for HPAH and LPAH (12,000 and 5,200 µg/kg -dw, respectively).

Several cores encountered refusal along the piling field area, including T25-SC02, T25-SC03, T25-SC04, T25-SC06, T25-SC07, T25-SC08, and T25-SC09B, T25-SC20, and T25-SC22. At each of these locations, the deepest available sediment core interval exceeded a Sediment SL for at least one COPC. The deepest interval at T25-SC03 (5.7 to 6.2 feet), only exceeded for total PAHs (Injury Threshold of 1,000 µg/kg; Figure 2-13). Although obstructions limited core depth in the piling field, adjacent cores in the Existing Sediment Area (EW10-SC08, T25-SC14, T25-SC17, and T25-SC24) and in the Future Sediment Area (SB02 and SB05) did fully delineate the vertical extent of contamination (Section 2.12.1). The vertical delineation in the adjacent cores can be used to estimate the depth of contamination in the sediment cores where refusal was encountered.

2.12.3 Groundwater

To assess the quality of shallow groundwater discharging from the Site to the EW, four shallow groundwater monitoring wells were installed and developed in the nearshore portion of the Site in October 2011 (Figure 2-7). Groundwater samples were collected from each well over the course of four monitoring events. Samples were analyzed for dissolved metals, SVOCs, PAHs, and PCB Aroclors. Arsenic and PAHs were detected at low concentrations in all monitoring wells throughout the four monitoring events. All other metals, SVOCs, and PCB Aroclors were not detected in any sample. Screening criteria were not developed for the Site groundwater data because the area in which the monitoring wells were located will be removed during marsh construction.

As discussed in Section 5.3, additional data will be collected to support evaluation of recontamination of the habitat restoration area along the upland boundaries of the Site.

2.12.4 Storm Drain Solids

One near-end-of-pipe storm drain solids sample was collected from the Site in 2020 to assess the current chemical quality of accumulated in-line storm drain solids. The storm drain solid sample location as well as current utilities and stormwater infrastructure are depicted in Figure 2-14. The sample was collected from drainage basin T25-7 at catch basin 10067, which is located in the Future Sediment Area. The sample was analyzed for PCB Aroclors, D/F, mercury, TOC, total solids, and grain size. PCB Aroclors, D/F, and mercury were detected in the sample. All stormwater lines and infrastructure will be removed from the Site during habitat restoration construction. The catch basin sample is not considered representative of conditions following habitat restoration construction, as this stormwater infrastructure will be removed during construction, with stormwater from off-site areas managed in a new stormwater feature.

3 Streamlined Risk Evaluation Approach, COPC Identification, and Conceptual Site Model

This section describes the approach that will be used in the EE/CA SRE; identification of preliminary exposure pathways, receptors, and COPCs, and development of the preliminary CSM. The COPCs and CSM presented in the following sections are preliminary and will be updated in the EE/CA following collection of supplemental data.

3.1 Streamlined Risk Evaluation Approach

The objective of the removal action is to address unacceptable potential future risks associated with the planned habitat restoration action. The SRE is being conducted to ensure that risks associated with the final future land use (marsh, intertidal, and subtidal zones) are at acceptable levels. Specifically, the SRE will evaluate the potential human health and ecological risks posed by Site COPCs for complete pathways and for receptors that were not already addressed in the EW SRI/FS.

The SRE approach that will be used in the EE/CA includes the following:

- Identification of complete and potentially complete exposure pathways and human and ecological receptors
- Development of a preliminary CSM
- Screening exposure media with risk-based SLs to identify COPCs
- Identification of COCs for which removal action levels will be developed

This EE/CA work plan addresses the first three steps of this approach and identifies the preliminary exposure pathways, receptors, preliminary COPCs, develops a preliminary CSM and identifies COPCs. The final step will be performed in the EE/CA and will include further evaluation of factors such as frequency of detection and frequency of SL exceedances.

The SRE will summarize prior assessments conducted on portions of the Site to determine Site COPCs for complete pathways not addressed in the EW SRI/FS that should be carried forward to the EE/CA and identify what additional evaluations are required.

3.1.1 Preliminary Exposure Pathways and Receptors

This section summarizes the receptors and complete exposure pathways evaluated in the EW human health (Windward 2012a) and ecological (Windward 2012b) risk assessments. Per the ASAOC, these receptors and exposure pathways are included for completeness, but are not further evaluated because the risks have been addressed by the EW SRI. Screening of Site media against SLs informs whether any additional COPCs beyond those identified as risk drivers in the EW SRI/FS need to be carried forward to the EE/CA.

Exposure pathways are the routes through which people or ecological organisms are exposed to contaminants in media (e.g., soils, sediments, and groundwater) at a site. Complete exposure pathways indicate that there is a contaminant source, a release and transport mechanism from a source, an exposure point where contact can occur, an exposure route through which contact can occur to a receptor population. The preliminary exposure pathways and receptors were identified based on the media the potential removal action may address and the future land uses following habitat restoration. The exposure pathways and receptors are summarized from the EW HHRA (Windward 2012a) and ERA (Windward 2012b; Appendices B and A of SRI, respectively; Windward and Anchor QEA 2014). Overall, no new habitat or exposure pathways or receptors were identified for the Site that were not already addressed in the EW risk assessments.

3.1.1.1 Upland

Potential human health and ecological exposures to future upland media (riparian zone and stormwater berm) post restoration are considered incomplete due to planned removal and backfill activities associated with Site restoration for this SRE based on proposed future use within the EW OU.

3.1.1.2 Aquatic

3.1.1.2.1 Aquatic Human Health

The EW HHRA identified five complete and significant exposure scenarios where humans may be exposed to contamination, either directly or indirectly via ingestion of seafood, as shown on Figure 3-1. The receptors and complete pathways evaluated quantitively in the EW HHRA included the following:

- Water recreation (e.g., swimming) including child and adult dermal contact and incidental ingestion of surface water
- Occupational exposure (habitat restoration) adult dermal contact and incidental ingestion of sediment
- Fish and crab collection (netfishing) including adult dermal contact and incidental ingestion of sediment
- Shellfish collection in intertidal areas adult dermal contact and incidental ingestion of sediment
- Consumption of resident seafood including Tribal and Asian Pacific Islander child and adult seafood consumption

These pathways are relevant to the Site and no additional pathways or receptors were identified that were not already addressed in the EW HHRA. In addition, the entirety of the Future Sediment Areas will incorporate clean backfill that will eliminate significant risk.

3.1.1.2.2 *Aquatic Ecological*

The EW ERA identified five types of ecological receptors of concern to represent receptors that may be exposed to contamination in the EW, either directly or indirectly via ingestion of prey, as shown on Figure 3-2. These receptors of concern and the complete and significant exposure pathways identified and evaluated quantitatively in the EW ERA include the following:

- Fish (juvenile Chinook salmon, English sole, Brown rockfish) exposure through direct water contact and benthic organism ingestion and Brown rockfish ingestion of fish
- Benthic community exposure through ingestion and direct contact with sediment; direct water contact, ingestion of benthos and other aquatic organisms (e.g., zooplankton, algae, terrestrial insects)
- Crab exposure through benthic organism ingestion; fish ingestion and direct water contact
- Piscivorous birds (osprey) and marine mammals (harbor seal) exposure through sediment ingestion, water ingestion, consumption of fish
- Piscivorous and benthivorous wildlife (river otter, pigeon guillemot) exposure through sediment ingestion, water ingestion, and consumption of fish, benthos and other aquatic organisms

Other complete exposure pathways of unknown significance and receptors considered less exposed due to foraging or diet were qualitatively discussed but were not further evaluated in the ERA (Windward 2012b). These pathways are relevant to the Site and no additional pathways or receptors were identified that were not already addressed in the EW ERA. In addition, the entirety of the Future Sediment Area will incorporate clean backfill that will eliminate significant risk.

The EW HHRA and ERA performed a risk-based screening to identify COPC followed by risk characterization to identify COCs and concluded by identifying risk drivers to support the FS. The following risk drivers (COCs and associated pathways) were identified in the EW HHRA and ERA following assessment of complete exposure pathways:

- Human health risk drivers: carcinogenic PAHs (cPAH TEQ), total PCBs and D/F TEQ (seafood consumption) and cPAH TEQ and arsenic (sediment direct contact).
- Ecological risk drivers: 28 COCs including metals, PAHs, phthalates, and other SVOCs (benthic macroinvertebrates); TBT (benthic macroinvertebrates); and total PCBs (benthic invertebrates; English sole, Brown rockfish).

The preliminary risk characterization presented in Section 3.1.2 includes comparison of Site data to SLs to identify any additional Site COPCs that may have not been addressed in the EW risk assessments, if they exist.

3.1.2 Preliminary Risk Characterization

This section discusses the initial screening of Site media to identify chemicals that may pose a potential risk to human or ecological receptors. The Sediment SLs are considered protective of different receptors as presented in Section 3.1.1. Chemical concentrations above the SLs indicate that further evaluation is warranted. Results of the COPC screening and preliminary COPCs are presented in Table 3-1. The purpose of this section is to complete a preliminary evaluation of whether potential risk to human or ecological receptors exists in the Restoration Area. The Future Sediment Area, and the existing EW Sediment Area were evaluated separately. The risk characterization process will be further refined in the EE/CA following collection of additional data.

3.1.2.1 Future Sediment Area

Potential risk to aquatic receptors is evaluated through comparison of maximum Site soil concentrations to the SLs discussed in Section 2.10.3. For each soil boring location, sample intervals at or below the approximate design subgrade elevation were screened against Sediment SLs protective of human and ecological receptors (Section 2.10.3). This screening is conservative because a layer of clean backfill suitable for habitat will be placed above the design subgrade elevation. Direct exposure to existing Site soil is unlikely to occur in the Future Sediment Area after the habitat has been constructed.

The initial screen for the Future Sediment Area indicates that the maximum concentration of multiple chemicals in the upland soil exceed the sediment SL (Table 3-1). These include SVOCs, PAHs, D/F, and total PCBs. Notably, 69% of samples exceed the SL for total PCBs. For total PCBs, the dry-weight SL is based on the NRDA Injury Threshold (128 µg/kg dw) and the OC-normalized SL is based on EW RAL (12 mg/kg-OC). Many of the samples were collected in the vicinity of SB03, where high concentrations of PCB were measured in 2019 samples (Section 2.7.8). When only considering samples away from SB03, 33% of samples exceed the SL for total PCBs with the maximum exceedances in SB09 (approximately 60 feet southeast of SB03) and SB11 (on the southern border of the Future Sediment Area). For SB09, the maximum detected concentration was 110 times higher than the NRDA Injury Threshold (9.1 to 10 foot depth interval; TOC: 9%). For SB11, the maximum detected concentration was 60 times higher than the EW RAL (9 to 11 foot depth interval; TOC: 0.67%).

3.1.2.2 Existing East Waterway Sediment Area

Potential risk to aquatic receptors is evaluated through comparison of maximum Site sediment concentrations to the SLs discussed in Section 2.10.3. All surface and subsurface sediment samples were screened against Sediment SLs protective of human and ecological receptors (Section 2.10.3).

The initial screen for the EW Sediment Area indicates that the maximum concentration of multiple chemicals in the sediment exceed the sediment SL (Table 3-1). These include metals, TBT, SVOCs, PAHs, D/F, and PCB Aroclors. Notably, 73% of samples exceeded the NRDA Injury Threshold for Total PAH (1,000 µg/kg) with the maximum detected concentration 150 times higher than the threshold (7 to 8 foot depth interval at station T25-SC08 near the northern edge of the Site boundary). For total PCBs, 43% of samples exceeded the SL, which uses a dry-weight SL based on the NRDA Injury Threshold (128 µg/kg dw) and an OC-normalized SL based on the EW RAL (12 mg/kg-OC). The maximum detected concentration is 131 times higher than the NRDA Injury Threshold (5 to 6 foot depth interval at Station T25-SC07 in the piling field).

3.2 Preliminary Contaminants of Potential Concern

Preliminary COPCs for the Site were identified through the screening process described in Sections 2.12 and 3.1.2. Chemicals exceeding SLs were further evaluated for comparison of detection limits relative to SLs. Chemicals that were not detected but had detection limits exceeding SLs were not retained as preliminary COPCs. VOCs without an SL, but with high concentrations were also identified as COPCs. These evaluations are described in Section 2.12. Preliminary COPCs were also identified as those chemicals that were determined to be Risk Driver COCs in EW sediments in the SRI/FS (Windward and Anchor QEA 2014). The preliminary COPCs based on the EW Risk Driver COC list, existing data, and applicable SLs are discussed in the following sections and are summarized in Table 3-1. These are considered preliminary and the identification of COPCs will be updated in the EE/CA after collection of additional data and potential refinement of the screening process.

Any chemical identified as a preliminary COPC at the Site, whether from the EW Sediment Area or Future Sediment Area, is considered a Site-wide preliminary COPC. As discussed in Section 2.12.3, groundwater data were not screened to determine potential COPCs because the area in which the monitoring wells were located will be removed during marsh construction and available groundwater data were classified as DQ-2 in Section 2.10. Because of this, the Site-wide preliminary COPCs are also considered preliminary COPCs for groundwater. In addition to the preliminary COPCs identified through comparison of maximum detected concentrations to Sediment SLs, all EW OU Risk Driver COCs are considered Site-wide preliminary COPCs. Six analyte classes are Site preliminary COPCs:

- Metals (Existing Sediment Area only)
- PAHs
- Tributyltin (Existing Sediment Area only)
- SVOCs
- VOCs (Future Sediment Area only)
- D/F
- PCB Aroclors

3.2.1 East Waterway Sediment Area and Future Sediment Area

The sediment samples collected from the EW Sediment Area and soil sampling in the Future Sediment Area were evaluated against the Sediment SLs presented in Table 2-2. Because soils in the Future Sediment Area will be excavated during habitat construction to create an emergent marsh, sample intervals at or below the approximate habitat restoration design surface elevation were screened against Sediment SLs protective of human and ecological receptors. All existing soil samples at or below this elevation were conservatively screened for identifying preliminary COPCs.

Forty-one preliminary COPCs were identified through the comparison of maximum detected concentrations to Sediment SLs (Table 3-1). Most chemicals only had exceedances in the EW Sediment Area. Preliminary COPCs include the following:

- Cadmium
- Chromium
- Lead
- Mercury
- Silver
- Zinc
- Tributyltin
- 1,2,4-Trichlorobenzene
- 1,4-Dichlorobenzene
- 2,4-Dimethylphenol
- 4-Methylphenol (p-Cresol)
- Benzoic acid
- Benzyl alcohol
- Bis(2-ethylhexyl)phthalate
- Diethyl phthalate
- Di-n-octyl phthalate
- n-Nitrosodiphenylamine
- Pentachlorophenol
- Phenol
- Butylbenzyl phthalate
- 2-Methylaphthalene
- Acenaphthene
- Anthracene
- Benzo(a)anthracene
- Benzo(b,j,k)fluoranthenes
- Benzo(g,h,i)perylene
- Chrysene

- Dibenzo(a,h)anthracene
- Dibenzofuran
- Fluoranthene
- Fluorene
- Indeno(1,2,3-c,d)pyrene
- Naphthalene
- Phenanthrene
- Pyrene
- Total Benzofluoranthenes
- Total high-molecular weight PAH
- Total low-molecular weight PAH
- Total PAH
- Total D/F
- Total PCB Aroclors

Additionally, 4-Isopropyltoluene was identified as a COPC due to high detected concentrations (results range between 1.2 and 72,900 µg/kg) in previously collected borings (SB07 and SB09).

3.2.2 East Waterway Site

In addition to the COPCs identified in the EW Sediment Area and Future Sediment Area, any Risk Driver COCs identified in the SRI/FS are included as preliminary COPCs. EW Site COCs not identified as COPCs in the EW Sediment and Future Sediment Areas include the following (Table 3-1):

- Arsenic
- Di-n-butyl phthalate
- Total carcinogenic PAHs

3.3 Preliminary Conceptual Site Model

This section presents the preliminary CSM, which has been developed based on available historical information, the current understanding of the environmental setting, and the findings of previous investigations, as presented in Section 2. The preliminary CSM will be updated in the EE/CA based on the data gaps investigation results. The CSM is a description of environmental conditions that includes sources of contamination, contaminant fate and transport in Site media, and potential routes of contaminant exposure for human and environmental receptors. A three-dimensional graphical CSM illustrating representative potential historical sources and migration of contaminants at the Site is provided in Figure 3-3. The CSM will be developed further during the EE/CA and SRE as more Site-related information and data are gathered.

3.3.1 On-Property Contaminant Sources

This section presents a summary of the on-property source areas and materials based on Site operational history presented in Section 2. Over time, the Site has been used for primarily cold storage and freezing for fruit and fish, fish processing, sawmill operations, and automobile preparation facility.

Original development of the upland site (early 1900s): Placement of fill material from unknown sources, over the historical nearshore land and tidelands next to the existing Spokane Street trestle. During this time, there was extensive dredging and filling activity, which reshaped the entire area. In addition to sediment fill placement at the Site, other upland fill materials (associated with the regrading of Beacon Hill and Denny Hill) were placed.

Compressor building and surrounding area (1916 to 1965; Figure 2-5): Practices in the building and surrounding areas included maintenance activities related to the compressor facility and forklift facility, and possible agricultural fumigation. Additional features of the building and surrounding area included a boiler, used oil storage, and substation. Possible contaminants include petroleum hydrocarbons associated with the boiler room and any tank that fueled it, petroleum hydrocarbons associated with compressor equipment and forklift maintenance activities, solvents (petroleum-based or chlorinated) associated with compressor and forklift maintenance activities, PCBs associated with electrical equipment; residual fumigants associated with the possible fumigation facility, and metals (lead and cadmium) associated with the maintenance of forklift batteries.

Former sawmill operations (1915 to 1960s; Figure 2-5): The Site was first developed as a sawmill, which evolved into a plywood and veneer plant by the time of its closing in 1960s. The primary COCs include petroleum related to machinery and vehicles, PCBs related to transformers and capacitors, and paint solvents.

Former automobile preparation facility (mid 1960s to early 1970s; Figure 2-5): After the sawmill operations were removed from the Site, an automobile preparation facility was developed to replace the sawmill operations. Possible contaminants associated with the automobile preparation facility's include petroleum hydrocarbons (predominantly kerosene), solvents (petroleum-based or chlorinated), paints and paint thinners.

3.3.2 Off-Property Contaminant Sources

This section presents a summary of the potential off-property source areas based on the adjacent property operational history presented in Section 2. As discussed in Section 2.2.3, the EW Sediment Area portion of the Site is located within the larger EW OU of the Harbor Island Superfund Site. Off-property sources of contamination to sediment include upgradient sources within the EW that could potentially migrate to existing and new sediment areas within the Site.

Off-property stormwater sources that discharge to outfalls and CSOs within the EW and LDW that are upgradient or immediately downgradient (via tidal exchange) of the Site are potential off-property contaminant sources.

As discussed in Section 2.9, investigations of properties in the vicinity to the Site have identified soil contamination. Although groundwater data are not available, contaminated soils could be a potential source through leaching to groundwater, which could discharge into the Future Sediment Area. Additional data will be collected to evaluate recontamination of sediments and surface water in the EE/CA.

3.3.3 Transport Mechanisms, Exposure Routes, and Potential Receptors

Potential contaminant transport mechanisms between media are shown conceptually in Figures 3-1 and 3-2, and include the following:

- Uptake of contaminants in sediment by aquatic biota
- Uptake of contaminants in surface water by aquatic biota

Based on the data collected to date, contaminants have been identified in EW sediments and in soils in the Future Sediment Area. Contaminant occurrences in these media may be due to direct releases or subsequent migration, as in the following examples:

- Soil contamination may be the result of contaminated fill materials, downward flows of contaminants through the subsurface and the sorption of contaminants from other media (e.g., soil vapor, infiltrating stormwater, or groundwater).
- Contaminants in sediment may be the result of direct releases to surface sediments (e.g., documented discharges from outfalls, undocumented spills, or migration of contaminated sediment from upgradient sources in the EW; subsurface migration of contaminated groundwater from the uplands, back erosion, abrasion and leaching of treated-wood structures, and migration through sediments).

Potentially complete exposure pathways for human receptors and associated risk drivers are summarized in Section 3.1.1 and shown conceptually in Figure 3-1. The risk driver exposure pathways for this Site, as identified in the EW risk assessments (Windward 2012a and 2012b) and based on future Site use, include the following:

- Incidental ingestion and direct contact of surface sediments for netfishers, tribal clammers, and recreational clammers in the Future Marsh Area and EW Sediment Area
- Ingestion of fish and shellfish for netfishers, tribal clammers, and recreational clammers

Potentially complete exposure pathways for ecological receptors applicable in the Future Sediment Area and EW Sediment Area are shown conceptually in Figure 3-2. The following risk driver exposure pathways for this Site include the following:

- Direct contact with surface sediments for benthic invertebrates
- Incidental ingestion of surface sediments for benthic invertebrates
- Ingestion of aquatic biota for benthic invertebrates and fish

3.3.4 Pathways of Concern

The principal contamination transport and exposure pathways of concern include the following:

- Incidental ingestion and direct contact for sediment
- Incidental ingestion and direct contact for surface water
- Fish and shellfish ingestion

4 Identification of Removal Action Goals and Objectives and Regulatory Requirements and Guidance

4.1 Removal Action Scope

The EE/CA will be prepared to define the scope and approach for the Non-Time Critical Removal Action (NTCRA) to support habitat restoration within the Site that is protective of human health and the environment. Information on nature and extent of contamination will be used to support the EE/CA. The NTCRA is intended to be the only action taken to clean up the Site. The EE/CA will demonstrate that the proposed action is sufficient to meet completion requirements. The anticipated removal action will address contamination only within the limits of the habitat restoration area and may consist of a single or combination of the following general response actions depending on the scope of the action:

- Removal
- Treatment
- Containment
- Engineered and institutional controls

Specific objectives will depend on the type of removal action that is selected.

The scope of the EE/CA also includes an assessment of recontamination potential from and to adjacent properties as described in Section 4.3. If recontamination potential onto the Site is identified, control of the sources by the respective property owners may be necessary prior to the commencement of the Site NTCRA.

4.2 Removal Action Goals, Objectives, and Site Use Considerations

The selected removal action will address contamination within the limits of the Site. A removal action goal specifies what is to be achieved by the removal action by addressing risks or by controlling or eliminating specific exposure pathways. The objectives are specific measures that meet the action goal and future site-specific cleanup levels while meeting the statutory limits and ARARs to the extent practicable (EPA 1993). The removal action goals, objectives, and cleanup criteria are determined by the future land use at the Site, which is anticipated to be a restored habitat, and the contamination present in each portion of the Restoration Area.

The goal of the removal action for the Site is to address potential exposure risks in a manner that is compatible with the habitat restoration project. The habitat restoration project includes removal of more than 5 acres of upland area and 5 acres of contaminated sediments along with restoration of marsh, intertidal, and subtidal habitat within and around the footprint of a former dock structure with creosote-piling, to create off-channel emergent marsh and riparian habitat. Future land use in the Site will include an aquatic habitat with a berm separating the marsh from the EW channel and an upland riparian buffer and stormwater feature.

The RAOs were set forth by EPA in the ASAOC and include addressing the following:

- Direct contact exposure and protection of benthic invertebrates, juvenile salmon, flatfish, and specific bird assemblages following habitat restoration
- Evaluation of potential recontamination of the Site from adjacent upland areas and the EW; adjacent upland areas include the remainder of the Site terminal and adjacent rights-of-way

The following RAOs are proposed for the Site removal action as a means of meeting the stated goals:

- Upland Soil
  - Manage remediation wastes in accordance with TSCA and RCRA requirements.
  - Reduce contaminant concentrations to meet the EW FS RALs in the short term and the PRGs in the long term.
- Groundwater
  - Prevent or reduce the potential for the migration of contaminants to the existing EW and Future Sediment Areas at concentrations that may cause sediment exceedances of the FS RALs in the near term and FS PRGs in the long term.
  - Achieve ARARs by removing or reducing groundwater contaminant concentrations to meet human health and ecological SLs and cleanup levels applicable to groundwater protective of sediment and surface water. Site groundwater would be classified as non-potable in accordance with the state MTCA regulation as outlined in Section 2.2.2, so achieving drinking water standards in groundwater is not a specific RAO for the EE/CA.
- Sediment
  - Reduce risks associated with the consumption of contaminated resident EW fish and shellfish by adults and children with the highest potential exposure to protect human health.
  - Reduce risks from direct contact (skin contact and incidental ingestion) to contaminated sediments during netfishing and clamming to protect human health.
  - Reduce to protective levels risks to benthic invertebrates from exposure to contaminated sediments.
  - Reduce to protective levels risks to crabs, fish, and birds from exposure to contaminated sediment, surface water, and prey.

The EE/CA will assess the need for a removal action and, if warranted, provide a recommended removal action alternative(s) for the Site including a description and rationale.

4.3 Recontamination Assessment Goals and Objectives

The goals of the recontamination assessment are as follows:

- Assess Site contaminant sources
- Characterize contaminant migration pathways from Site sources and evaluate the potential for recontamination of existing EW and Future Sediment Areas at concentrations exceeding EW FS RALs and PRGs
- Characterize contaminant migration from and to adjacent sites
- Increase the likelihood of the permanence of the NTCRA

4.4 Preliminary Review and Analysis of Regulatory Requirements and Guidance

4.4.1 Development of Applicable or Relevant and Appropriate Requirements

CERCLA Section 121(d) requires remedial actions to comply with (or formally waive) ARARs, which are defined as any legally applicable or relevant and appropriate standard, requirement, criterion, or limitation under any federal environmental law, or promulgated under any state environmental or facility siting law that is more stringent than the federal requirements. This subsection identifies ARARs for cleanup of the EW OU, which are also applicable to the NTCRA. The Site EE/CA will evaluate whether the removal action developed for cleanup of the Site comply with these ARARs.

The National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR 300.5) defines applicable requirements as the more stringent among those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances found at a CERCLA site. A requirement may not be applicable, but nevertheless may be relevant and appropriate.

Table 4-1 lists and summarizes ARARs identified for the EW OU that are also applicable to the Site. Some ARARs prescribe minimum numerical requirements or standards for specific media such as sediment, surface water, and groundwater. Other ARARs place requirements or limitations on actions that may be undertaken as part of a remedy.

Some ARARs contain numerical values or methods for developing such values. These ARARs establish minimally acceptable amounts or concentrations of hazardous substances that may remain in or be released to the environment, or minimum standards of effectiveness and performance expectations for the remedial alternatives. Risk-based target concentrations based on risks to human health or the environment may dictate setting more stringent standards for remedial action performance, but they cannot be used to relax the minimum legally prescribed standards in ARARs (EPA 1991). The rest of this subsection focuses on ARARs containing specific minimum numerical standards.

Washington State has enacted environmental laws and promulgated regulations to implement or co-implement several major federal laws through federally approved programs, such as the Clean Water Act (CWA), Clean Air Act, and RCRA. Washington's state cleanup law, MTCA, is an ARAR for the EW OU, and sediment sites under MTCA are regulated by SMS, which promulgates methods for developing and complying with cleanup levels. The Sediment SLs are developed in Section 2.10.3 to comply with SMS.

Recommended federal WQC developed to protect ecological receptors and human consumers of fish and shellfish are relevant and appropriate requirements pursuant to CERCLA Section 121 (d)(2)(A)(ii) and Revised Code of Washington 70.105D.030(2). Although Aquatic Life WQC and Human Health WQC for the Consumption of Organisms Only are ARARs for the EW, Human Health WQC for Consumption of Organisms and Water are not relevant because neither the EW nor the Site are a source of drinking water. Under CERCLA, state water quality standards (WQS) approved by EPA are generally applicable requirements under the CWA. National recommended federal WQC established pursuant to Section 304(a)(1) of the CWA are compiled and presented on the EPA website[2]. Although these criteria are advisory for CWA purposes (to assist states in developing their standards), the last sentence of CERCLA Section 121(d)(2)(A)(ii) makes them generally relevant and appropriate requirements for CERCLA site remedial actions.

Consequently, the more stringent of the recommended federal marine WQC and the state marine WQS are ARARs for the site. Washington State WQS for the protection of aquatic life found at WAC 173-201A-240 meet the federal requirements of Section 303I(2)(B) of the CWA and are at least as stringent as the recommended federal WQC. Furthermore, in Washington State, an antidegradation policy helps prevent unnecessary lowering of water quality (WAC 173-201A-300 through WAC 173-201A-410). It is also recognized that portions of many waterbodies cannot meet the assigned criteria due to the natural conditions of the waterbody. Per WAC 173-201A-260, when a waterbody does not meet its assigned criteria due to human structural changes that cannot be effectively remedied (as determined consistent with the federal regulations at 40 CFR 131.10), then alternative estimates of the attainable water quality conditions, plus any further allowances for human effects specified in this section for when natural conditions exceed the criteria, may be used to establish an alternative criteria for the waterbody (see WAC 173-201A-430 and 173-201A-440)[3]. Therefore, toxic, radioactive, or deleterious material concentrations must be below those that have

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[2] https://www.epa.gov/wqc/national-recommended-water-quality-criteria-tables
[3] Alternative criteria have not been developed for the East Waterway at this time.

the potential, either singularly or cumulatively, to adversely affect characteristic water uses, cause acute or chronic conditions to the most sensitive biota dependent upon those waters, or adversely affect public health (see WAC 173-201A-240, toxic substances, and 173-201A-250, radioactive substances).

5 Data Gaps Assessment and Investigation Approach

The purpose of this section is to summarize data gaps and needs (Figure 5-1) to support the EE/CA and for design of the removal action and habitat restoration. As discussed in Section 2.2.3, the cleanup will include performing the Selected Remedy that will be identified by EPA in the ROD for the existing EW Sediment Area. It will also include cleanup needed to support habitat restoration in the Future Sediment Area and source control activities needed to be performed in the Future Modified Upland Area to prevent recontamination of the sediments. The identified data gaps and needs are intended to support the EE/CA as well as the design of the cleanup and restoration.

5.1 Sediment Data Gaps

As discussed in Section 2.12.2, the vertical extent of contamination was fully delineated at 19 locations within the Existing Sediment Area, most of which were collected in 2021 under EPA oversight to support further design-level sampling to support the cleanup action and habitat restoration. At other locations, mostly within the Site piling field where deep core intervals were not recovered due to refusal or sampling was limited by access, the deepest available sediment core interval exceeded a SL for at least one COPC. Although the vertical extent of sediment contamination in some areas of the Site piling field has not been determined, additional sampling is not proposed due to previous refusal and access limitations associated with the piling field in this area. Instead, existing data from surrounding sediment cores and shoreline borings will be used to extrapolate the depth of contamination in this area for the EE/CA Report and for design purposes. In addition, post-construction (post-dredge) sampling will be performed in the existing sediment areas of the piling field to assess the leave surface prior to placement of backfill and to assess whether additional contingency dredging will be required in these areas. Therefore, no data gaps for sediments have been identified relative to the EE/CA (other than the use of these data to evaluate potential recontamination pathways from the Site to the EW, as described in Section 4.3).

5.2 Soil Data Gaps

Data gaps applicable to soil include supplementing the existing DQ-1 chemical concentration data. Additional borings in the Future Sediment Area are proposed to evaluate the nature and extent (horizontal and vertical) of soil contamination within or below the anticipated future habitat grade and the extent of PCB concentrations in soils to be removed that exceed the TSCA remediation waste threshold of 50,000 µg/kg. To the extent practicable, source materials remaining in the subsurface need to be identified, and the fate and transport pathways within and from soil need to be further evaluated. Evaluations of fate and transport need to incorporate chemical data, geotechnical and physical properties data, and subsurface investigations of obstructions or preferential pathways (e.g., wood debris) that could be related to sources or impact removal actions. Evaluations of pathway completeness and sediment recontamination in the Future Sediment Areas will need to incorporate soil data for use in the SRE. The specific data needs to fill soil data gaps are discussed below.

Additional soil data are needed to support the EE/CA. Additional upland soil borings are needed to characterize the pre-construction conditions and identify the limits of known COCs at the Site prior to the restoration. Chemical and physical soil data are needed throughout the Site where previous exceedances of Sediment SLs or potential sources have been identified based on historical Site activities. Chemical and physical data are also needed in areas where previous data was collected but does not satisfy project DQOs.

Chemical data needs for soil include additional subsurface soil samples within the Future Sediment Area, at and below the habitat grades, to characterize the nature and extent of contamination and basic soil geochemistry. This includes sampling of soil in the Fill Unit and Upland Area Lower Alluvium Unit where not already characterized.

Physical data needs for soil include collection of conventional soil parameters (such as TOC, total solids, moisture content, grain size, etc.) and geotechnical data. Geotechnical data will help to characterize Site subsurface conditions, support the evaluation of removal action technologies within the Future Sediment Area and Future Modified Upland Area, and inform overall engineering design of the habitat restoration project.

In particular, geotechnical data are required to inform slope stability evaluations, seismic performance evaluations, dredge and excavation prism development; engineered cap and backfill design; and work restrictions, if appropriate, around existing infrastructure, utilities, and debris. While the design will specify the allowance for the use of specific remedial technologies, geotechnical data are also required to allow the contractor to select suitable equipment for use during construction. The *Data Report: Soil and Subsurface Sediment Characterization Report* (Anchor QEA 2021a) summarizes the geotechnical testing results from upland boring sampling conducted in January 2019. To supplement these geotechnical data, other potential pre-design data will be collected to include the following information[4]:

- **Shear Strength.** Shear strength data are required to inform general sediment and soil stability design considerations, develop stable dredge and excavation cuts (i.e., side-slopes), assess bank stability, and characterize sediment dredgeability and soil excavation. Subgrade sediment and soil shear strength data are also required to inform engineered capping design. Specific methods for the collection of shear strength data may include in situ vane shear test,

[4] Note that not every area will need every geotechnical analysis. For example, index properties are likely to be correlated with the other properties and thus, other geotechnical properties will not likely be needed at every location.

cone penetrometer tests, or correlations of shear strength to standard penetration test or laboratory geotechnical index parameter testing.

- **Consolidation Settlement.** Sediment and soil compressibility data are required to determine how the fine-grained subgrade materials will consolidate (i.e., settle) following engineered cap or backfill placement. Consolidation of placed cap materials must also be evaluated to assist with interpreting cap thickness verification surveys (i.e., topographic changes due to consolidation should be considered when evaluating post-construction cap elevation surveys). Specific methods for the collection of subgrade consolidation settlement data include use a Shelby tube (as a separate effort from collection of environmental data) to collect an undisturbed sediment or soil sample for laboratory analysis. Consolidation settlement data will also be correlated to geotechnical laboratory index properties.
- **Index Properties.** Geotechnical index properties include grain size, moisture content, bulk density, specific gravity, and plasticity (i.e., Atterberg Limits). These data are required to inform all facets of engineering design, including dredging, excavation, capping, and backfilling, and to assess bank and in-water slope stability. Index property data are also useful in the design of sediment and soil handling, transport, dewatering, and treatment systems. Index properties can be correlated with shear strength and compressibility parameters and are used as another line of consideration when assigning design parameters for geotechnical engineering evaluations.

The specific geotechnical methods are described in the SQAPP (Appendix B).

5.3 Groundwater Data Gaps

Groundwater-related data gaps include groundwater quality measured in new monitoring wells to be installed in the Future Modified Upland Area to evaluate the lateral extent of groundwater concentrations relative to groundwater recontamination SLs, which are protective of sediment and surface water, in order to assess the quality of groundwater that will discharge to the future habitat restoration area. Similar to soil, data gaps for groundwater quality include collecting DQ-1 chemical concentration data. The specific data needs to fill groundwater data gaps are discussed below.

Additional groundwater data are needed to support EE/CA recontamination evaluations. New groundwater wells are needed to characterize groundwater quality that will discharge into the proposed habitat area after the habitat restoration is complete. Groundwater quality data are needed in areas upgradient of the Future Sediment Area within the Future Modified Upland Area along the Site perimeter in areas that have not been previously investigated.

5.4 Survey Data Gaps

The most current topographic and bathymetric surveys were conducted at the Site between 2017 and 2019. Supplemental topographic and bathymetric information is needed for specific areas of the Site to inform the EE/CA and the habitat restoration design with a comprehensive overlapping topographic and bathymetric dataset. The additional topographic and bathymetric surveys will provide detailed elevation information (contours) within the Future Sediment Area and within the Future Modified Upland Area, assist with dredge and excavation and cap and backfill calculations, evaluate slope stability, and assess habitat conditions and considerations.

5.5 Data Quality Objectives

The data needs identified in Sections 5.2, 5.3, and 5.4 have been developed through a methodical planning process to ensure appropriate sampling, analyses, and data evaluations are conducted to meet the EE/CA objectives. EPA's Guidance on Systematic Planning Using the Data Quality Objective Process (EPA 2006) was used to identify the necessary data to develop the EE/CA, through the DQO process. The seven-step DQO process is a tool to determine the type, quantity, and quality of data necessary for any subject analysis. The seven steps are as follows:

1. State the Problem
2. Identify the Goal of the Study
3. Identify Information Inputs
4. Define the Boundaries of the Study
5. Develop the Analytic Approach
6. Specify Performance or Acceptance Criteria
7. Develop the Plan for Obtaining the Data

DQOs were developed to address the data needs identified in Sections 5.2, 5.3, and 5.4. DQOs have been developed for the following three aspects of the EE/CA:

1. Site Physical Characteristics and Surveys (Table 5-1)
2. Nature and Extent of Contamination in Soil (Table 5-2)
3. Nature and Extent of Contamination in Groundwater (Table 5-3)

5.6 Data Gaps Investigation Approach

The investigation areas, media to be sampled, and chemical analyses to be conducted are described in the following sections.

5.6.1 Investigation Areas

The Future Sediment Area and Future Modified Upland Area discussed in Section 2.10.3 will be further investigated to fill EE/CA data gaps. Sample locations will be focused in and around areas with sediment SL exceedances based on the preliminary CSM (Section 3.3) and current nature and extent (Section 2.12) and data gaps (Sections 5.2 and 5.3). The initial horizontal limits of the investigation areas will be within the Future Sediment Area and Future Modified Upland Area of the Site. The process for collecting additional data is described in the following subsections.

5.6.2 Media to Be Sampled

Based on the preliminary CSM (Section 3.3), nature and extent of contamination (Section 2.12), and the anticipated habitat restoration at the Site, the media that will be sampled as part of the EE/CA data gaps investigation will include the following:

- Soil: chemical and physical analysis in the Future Sediment Area and Future Modified Upland Area
- Groundwater: chemical analysis in the Future Modified Upland Area

Physical analyses for soil are described in Section 5.2. Chemical analyses for soil and groundwater area described below in Section 5.6.3.

5.6.3 Chemical Analysis

The chemical analysis needed by media and area to meet DQOs include the following:

- Soil (chemical analysis of soils at the surface of and beneath the future habitat grade in the Future Sediment Area and chemical analysis of shallow soils in the Future Modified Upland Area)
  - PCB Aroclors
  - Metals (e.g., arsenic, cadmium, chromium, lead, mercury, silver, and zinc)
  - PAHs
  - SVOCs
  - D/F
  - VOCs (for locations in the vicinity of previous detections)
- Groundwater (chemical analysis from the Upland Fill Unit and Upland Area Lower Alluvium)
  - PCB Aroclors
  - Total and dissolved metals (e.g., arsenic, cadmium, chromium, lead, mercury, silver, and zinc)
  - PAHs
  - SVOCs
  - D/F

The specific analytical methods, sample locations and depth intervals, and sample collection and handling methods are included in the SQAPP (Appendix B).

5.7 Adaptive Management

Adaptive management is a structured and iterative decision-making process that improves management decisions and reduces uncertainty over time as the outcomes of earlier decisions are monitored and lessons learned are incorporated. For the Site EE/CA process, two levels of adaptive management are reasonably anticipated, as described below.

While acquiring data described by the DQOs included herein, additional data needs may be identified in the field. For example, if field screening (visual, olfactory, photoionization detector) indicates contamination to not be bounded, additional borings may be advanced, in consultation with EPA field oversight, to obtain needed information. This process can be resolved between the Port and EPA during the data acquisition process through field change documentation.

Following review and initial interpretation of information collected to address the DQOs in this document, additional data needs and DQOs may be identified to complete the EE/CA Report. An example would be sampling to address fate and transport of chemicals that require specialized characterization techniques. In this case, an EE/CA Work Plan Addendum would be required requiring formal EPA approval process.

6 Approach to the Selection of Removal Action Alternatives

6.1 Identification of Remedial Technologies

The EE/CA will focus on the most applicable and demonstrated remedial technologies appropriate for the size, time frame, and site-specific conditions that address contamination and support the design of the habitat restoration for the Site. Each technology will be evaluated in the EE/CA for its applicability to the Site removal action. While the remedial technologies to be evaluated in the EE/CA in Existing EW Sediment Areas will be limited to those that are expected to be part of cleanup remedy identified by EPA in the future EW ROD, the Future Sediment Area, and Future Modified Upland Area will consider removal, treatment, and containment, and disposal as potentially applicable remedial technologies.

Other remedial technologies may be considered in the technology screening process if required to address any potential ongoing sources within the Future Sediment Area and Future Modified Upland Area.

6.2 Identification and Evaluation of Preliminary Removal Action Alternatives

Remedial technologies will be used to develop removal action alternatives. It is anticipated that two removal action alternatives for the Future Sediment Area and Future Modified Upland Area will be developed in the EE/CA for inclusion in the comparative analysis. Both alternatives are expected to include the same remediation technologies for the Existing Sediment Area, consistent with the remedy expected to be identified by EPA in the ROD. The first removal action alternative in the Future Sediment Area and Future Modified Upland Area will represent the "maximum feasible" removal action in terms of the extent and level of Site cleanup and a second removal alternative that will remove necessary contamination to support backfill of clean material to the required habitat restoration elevations. A no action alternative will not be included in the EE/CA because the Port's planned land use at the Site is to construct the habitat restoration project to settle claims of natural resource damages with the Trustees. The evaluation of each removal action alternative will include the following:

- Description of its remedial components
- Extent of the removal action and anticipated soil and groundwater quantities associated with removal
- Estimated contaminant soil and groundwater concentrations remaining
- Achievement of RAOs for the EW Superfund Site, the Future Sediment Area, and the Future Modified Upland Area
- Their effectiveness, implementability, and cost

6.3 Comparative Analysis of Removal Action Alternatives

The evaluation criteria described in the NTCRA guidance (EPA 1993) will be applied as a means of comparing the removal action alternatives in the EE/CA. The three broad criteria (Effectiveness, Implementability, Cost) and associated subcriteria listed in the EPA guidance will be described and used to evaluate the removal action alternatives and to identify a recommended removal action alternative.

6.4 Recommended Removal Action Alternative

The EE/CA Report will describe the selected removal action alternative including graphics (e.g., cross sections and plan view maps) showing areas where specific removal, treatment, and containment remedial technologies and institutional controls will be applied at the Site.

7 References

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Tables

Table 2-1
Summary of Data Quality Review for Existing Site Data

				Work Plan Documentation		Sample Location and Collection Methods				
Study	Reference	Media	Sample Years	Work Plan (SAP/QAPP)	Purpose of Sample Collection	Location Method, Accuracy, and Datum	Sample Depths	Collection Method and Matrix	Sample Collection, Processing, and Handling	Holding Time, Preservation, and Chain of Custody
Soil and Groundwater										
Environmental site assessment	BEI (1989)	Soil	1988	Unknown	Environmental site assessment	Locations available; collection method and accuracy unknown	Yes	Yes	Yes	Unknown
Subsurface investigation report	Sweet-Edwards/EMCON, Inc. (1990)	Soil and groundwater	1989	Unknown	Post-excavation sampling after removal of underground gasoline storage tank	Locations based on paper map interpolations; accuracy unknown	Unknown	Yes	Unknown	Yes
Soil and groundwater investigation, Site maintenance building	Landau and EcoChem (1990)	Soil and groundwater	1990	Unknown	Recontamination evaluation	Locations available; collection method and accuracy unknown	Yes	Yes	Yes	Yes
Site investigation	Anchor QEA and Aspect (2012)	Soil and groundwater	2011/2012	Yes	Collection of environmental source control data	Locations based on GPS; accuracy: ±3 feet	Yes	Yes	Yes	Yes
Site soil and subsurface sediment characterization	Anchor QEA (2021a)	Soil	2019/2020	Yes	Habitat restoration project support and planning	Locations based on GPS; accuracy: ±3 feet	Yes	Yes	Yes	Yes
Sediment										
EW nature and extent of contamination	Windward (2002)	Sediment	2001	Yes	Nature and extent of contamination	Locations based on GPS; accuracy: ±3 feet	Yes	Yes	Yes	Yes
EW surface sediment sampling for chemical analyses and toxicity testing	Windward (2010)	Sediment	2009	Yes	Nature and extent of contamination	Locations based on GPS; accuracy: ±3 feet	Yes	Yes	Yes	Yes
EW suburface sediment sampling for chemical analyses	Windward (2011)	Sediment	2010	Yes	Nature and extent of contamination	Locations based on GPS; accuracy: ±3 feet	Yes	Yes	Yes	Yes
Site investigation	Anchor QEA and Aspect (2012)	Sediment	2011/2012	Yes	Collection of environmental source control data	Locations based on GPS; accuracy: ±3 feet	Yes	Yes	Yes	Yes
Site soil and subsurface sediment characterization	Anchor QEA (2021a)	Sediment	2019/2020	Yes	Habitat restoration project support and planning	Locations based on GPS; accuracy: ±2 feet (WGS84)	Yes	Yes	Yes	Yes
Site subsurface sediment characterization	Anchor QEA (2022)	Sediment	2021	Yes	Habitat restoration project support and planning	Locations based on GPS; accuracy: ±2 feet (WGS84)	Yes	Yes	Yes	Yes

Table 2-1
Summary of Data Quality Review for Existing Site Data

				Laboratory Analysis			Quality Control and Data Validation		
Study	Reference	Media	Sample Years	Analytical Methods Are Standard or EPA Approved	Detection Limits and Qualifiers Determined Based on EPA Guidance	Measurement Instruments and Calibration Procedures	Field/Lab Quality Control Samples (Duplicates and Blanks)	Analytical Chemistry Data Validated and Qualified Consistent with EPA Functional Guidelines	Laboratory Data Reports
Soil and Groundwater									
Environmental site assessment	BEI (1989)	Soil	1988	Yes	Unknown	Unknown	None	Unknown	Yes
Subsurface investigation report	Sweet-Edwards/EMCON, Inc. (1990)	Soil and groundwater	1989	Yes	Unknown	Unknown	Yes	Unknown	Yes
Soil and groundwater investigation, Site maintenance building	Landau and EcoChem (1990)	Soil and groundwater	1990	Yes	Yes	Unknown	Partial	Unknown	Yes
Site investigation	Anchor QEA and Aspect (2012)	Soil and groundwater	2011/2012	Yes	Yes	Yes	Yes	Yes	Yes
Site soil and subsurface sediment characterization	Anchor QEA (2021a)	Soil	2019/2020	Yes	Yes	Yes	Yes	Yes	Yes
Sediment									
EW nature and extent of contamination	Windward (2002)	Sediment	2001	Yes	Yes	Yes	Yes	Yes	Yes
EW surface sediment sampling for chemical analyses and toxicity testing	Windward (2010)	Sediment	2009	Yes	Yes	Yes	Yes	Yes	Yes
EW suburface sediment sampling for chemical analyses	Windward (2011)	Sediment	2010	Yes	Yes	Yes	Yes	Yes	Yes
Site investigation	Anchor QEA and Aspect (2012)	Sediment	2011/2012	Yes	Yes	Yes	Yes	Yes	Yes
Site soil and subsurface sediment characterization	Anchor QEA (2021a)	Sediment	2019/2020	Yes	Yes	Yes	Yes	Yes	Yes
Site subsurface sediment characterization	Anchor QEA (2022)	Sediment	2021	Yes	Yes	Yes	Yes	Yes	Yes

Table 2-1
Summary of Data Quality Review for Existing Site Data

				Quality Control and Data Validation (cont.)	
Study	**Reference**	**Media**	**Sample Years**	**Groundwater Data <10 Years Old**	**Data Quality**
Soil and Groundwater					
Environmental site assessment	BEI (1989)	Soil	1988	Not applicable	DQ-2
Subsurface investigation report	Sweet-Edwards/EMCON, Inc. (1990)	Soil and groundwater	1989	No	DQ-2
Soil and groundwater investigation, Site maintenance building	Landau and EcoChem (1990)	Soil and groundwater	1990	No	DQ-2
Site investigation	Anchor QEA and Aspect (2012)	Soil and groundwater	2011/2012	No	DQ-1
Site soil and subsurface sediment characterization	Anchor QEA (2021a)	Soil	2019/2020	Not applicable	DQ-1
Sediment					
EW nature and extent of contamination	Windward (2002)	Sediment	2001	Not applicable	DQ-1
EW surface sediment sampling for chemical analyses and toxicity testing	Windward (2010)	Sediment	2009	Not applicable	DQ-1
EW suburface sediment sampling for chemical analyses	Windward (2011)	Sediment	2010	Not applicable	DQ-1
Site investigation	Anchor QEA and Aspect (2012)	Sediment	2011/2012	Not applicable	DQ-1
Site soil and subsurface sediment characterization	Anchor QEA (2021a)	Sediment	2019/2020	Not applicable	DQ-1
Site subsurface sediment characterization	Anchor QEA (2022)	Sediment	2021	Not applicable	DQ-1

Table 2-1
Summary of Data Quality Review for Existing Site Data

Notes:

Windward (Windward Environmental LLC), 2002. *East Waterway, Harbor Island Superfund Site: Nature and Extent of Contamination Surface Sediment Data Report - Phases 1 and 2.* Prepared for the Port of Seattle.

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EPA: U.S. Environmental Protection Agency

EW: East Waterway

QAPP: quality assurance project plan

SAP: sampling and analysis plan

Site: Terminal 25 South Site

WGS84: World Geodetic System 1984

Table 2-2
Initial Screening Levels for East Waterway Sediment and Future Sediment Area

Analyte	SMS Marine SCO	AET Marine SCO	EW RAL	LDW NRDA Injury Threshold	Sediment SL
Metals (mg/kg)					
Arsenic	57	57	57	57	**57**
Cadmium	5.1	5.1	--	2.7	**2.7**
Chromium	260	260	--	63.5	**63.5**
Copper	390	390	--	270	**270**
Lead	450	450	--	360	**360**
Mercury	0.41	0.41	0.41	0.41	**0.41**
Silver	6.1	6.1	--	3	**3**
Zinc	410	410	--	410	**410**
Organometallic Compounds (mg/kg-OC)					
Tributyltin (ion)	--	--	7.5	--	**7.5**
Organometallic Compounds (µg/kg)					
Tributyltin (ion)	--	--	--	102	**102**
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)					
2-Methylnaphthalene	38	--	--	--	**38**
Acenaphthene	16	--	16	--	**16**
Acenaphthylene	66	--	--	--	**66**
Anthracene	220	--	--	--	**220**
Benzo(a)anthracene	110	--	--	--	**110**
Benzo(a)pyrene	99	--	--	--	**99**
Benzo(b,j,k)fluoranthenes	230	--	--	--	**230**
Benzo(g,h,i)perylene	31	--	--	--	**31**
Chrysene	110	--	--	--	**110**
Dibenzo(a,h)anthracene	12	--	--	--	**12**
Dibenzofuran	15	--	--	--	**15**
Fluoranthene	160	--	160	--	**160**
Fluorene	23	--	23	--	**23**
Indeno(1,2,3-c,d)pyrene	34	--	--	--	**34**
Naphthalene	99	--	--	--	**99**
Phenanthrene	100	--	100	--	**100**
Pyrene	1000	--	--	--	**1000**
Total benzofluoranthenes (b,j,k) (U = 0)	230	--	--	--	**230**
Total benzofluoranthenes (laboratory-reported total)	230	--	--	--	**230**
Total HPAH (SMS) (U = 0)	960	--	--	--	**960**
Total LPAH (SMS) (U = 0)	370	--	--	--	**370**
Polycyclic Aromatic Hydrocarbons (µg/kg)					
2-methylnaphthalene	--	670	--	--	**670**
Acenaphthene	--	500	--	--	**500**
Acenaphthylene	--	1300	--	--	**1300**
Anthracene	--	960	--	--	**960**
Benzo(a)anthracene	--	1300	--	--	**1300**
Benzo(a)pyrene	--	1600	--	--	**1600**
Benzo(b,j,k)fluoranthenes	--	3200	--	--	**3200**
Benzo(g,h,i)perylene	--	670	--	--	**670**
Chrysene	--	1400	--	--	**1400**
Dibenzo(a,h)anthracene	--	230	--	--	**230**
Dibenzofuran	--	540	--	--	**540**
Fluoranthene	--	1700	--	--	**1700**
Fluorene	--	540	--	--	**540**
Indeno(1,2,3-c,d)pyrene	--	600	--	--	**600**
Naphthalene	--	2100	--	--	**2100**
Phenanthrene	--	1500	--	--	**1500**
Pyrene	--	2600	--	--	**2600**
Total benzofluoranthenes (b,j,k) (U = 0)	--	3200	--	--	**3200**
Total benzofluoranthenes (laboratory-reported total)	--	3200	--	--	**3200**
Total HPAH (SMS) (U = 0)	--	12000	--	--	**12000**
Total LPAH (SMS) (U = 0)	--	5200	--	--	**5200**
Total PAH (16) (U = 0)	--	--	--	1000	**1000**
PCB Aroclors (mg/kg-OC)					
Total PCB aroclors (Ecology 2021) (U = 0)	12	--	12	--	**12**
PCB Aroclors (µg/kg)					
Total PCB aroclors (Ecology 2021) (U = 0)	--	130	--	128	**128**
Semivolatile Organics (mg/kg-OC)					
1,2,4-trichlorobenzene	0.81	--	--	--	**0.81**
1,2-dichlorobenzene	2.3	--	--	--	**2.3**
1,4-dichlorobenzene	3.1	--	3.1	--	**3.1**
Bis(2-ethylhexyl)phthalate	47	--	--	--	**47**
Butylbenzyl phthalate	4.9	--	4.9	--	**4.9**
Diethyl phthalate	61	--	--	--	**61**
Dimethyl phthalate	53	--	--	--	**53**
Di-n-butyl phthalate	220	--	--	--	**220**
Di-n-octyl phthalate	58	--	--	--	**58**
Hexachlorobenzene	0.38	--	--	--	**0.38**
Hexachlorobutadiene (hexachloro-1,3-butadiene)	3.9	--	--	--	**3.9**
n-Nitrosodiphenylamine	11	--	--	--	**11**
Semivolatile Organics (µg/kg)					
1,2,4-trichlorobenzene	--	31	--	31	**31**
1,2-dichlorobenzene	--	35	--	35	**35**
1,4-dichlorobenzene	--	110	--	110	**110**
2,4-dimethylphenol	29	29	--	29	**29**
2-Mmethylphenol (o-cresol)	63	63	--	--	**63**
4-methylphenol (p-cresol)	670	670	--	110	**110**
Benzoic acid	650	650	--	--	**650**
Benzyl alcohol	57	57	--	--	**57**
Bis(2-ethylhexyl)phthalate	--	1300	--	1300	**1300**
Butylbenzyl phthalate	--	63	--	63	**63**

Table 2-2
Initial Screening Levels for East Waterway Sediment and Future Sediment Area

Analyte	SMS Marine SCO	AET Marine SCO	EW RAL	LDW NRDA Injury Threshold	Sediment SL
Diethyl phthalate	--	200	--	--	**200**
Dimethyl phthalate	--	71	--	71	**71**
Di-n-butyl phthalate	--	1400	--	1400	**1400**
Di-n-octyl phthalate	--	6200	--	61	**61**
Hexachlorobenzene	--	22	--	22	**22**
Hexachlorobutadiene (hexachloro-1,3-butadiene)	--	11	--	11	**11**
n-nitrosodiphenylamine	--	28	--	--	**28**
Pentachlorophenol	360	360	--	--	**360**
Phenol	420	420	--	180	**180**
Pesticides (μg/kg)					
Sum DDD (U = 0)	--	--	--	16	**16**
Sum DDE (U = 0)	--	--	--	9	**9**
Sum DDT (U = 0)	--	--	--	12	**12**
Dioxins and Furans (ng/kg)					
Total dioxin/furan TEQ 2005 (mammal) (U = 0)	--	--	25	--	**25**
Total dioxin/furan TEQ 2005 (mammal) (U = 1/2)	--	--	25	--	**25**

Notes:

Ecology, 2021. Sediment Cleanup User's Manual. Guidance for Implementing the Cleanup Provisions of the Sediment Management Standards, Chapter 173-204 WAC. Third Revision. December 2021.

NOAA (National Oceanic and Atmospheric Administration), 2013. *Final Lower Duwamish River NRDA Restoration Plan and Programmatic Environmental Impact Statement*. Prepared by the National Oceanic and Atmospheric Administration on behalf of the Lower Duwamish River Natural Resource Damage Assessment Trustee Council. Appendix C: Defining Injuries to Natural Resources in the Lower Duwamish River. June 2013.

--: not applicable
μg/kg: micrograms per kilogram
AET: apparent effects threshold
DDD: dichlorodiphenyldichloroethane
DDE: dichlorodiphenyldichloroethylene
DDT: dichlorodiphenyltrichloroethane
EW: East Waterway
HPAH: high-molecular-weight polycyclic aromatic hydrocarbon
LDW: Lower Duwamish Waterway
LPAH: low-molecular-weight polycyclic aromatic hydrocarbon
mg/kg: milligrams per kilogram
mg/kg-OC: milligrams per kilogram-organic carbon
ng/kg: nanograms per kilogram
NRDA: Natural Resources Damage Assessment
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
RAL: remedial action level
RAO: remedial action objective
SCO: sediment cleanup objective
SL: screening level
SMS: Sediment Management Standards
TEQ: toxic equivalents quotient

Table 2-3
Summary of Existing Soil Data Detections and Exceedances

Analyte	Number of Locations	Number of Samples	Number of Detections	Maximum Detected Result	Maximum Exceedance Ratio	Minimum Detected Result	Sediment SL	Number of Detections >Sediment SL[1]	Number of Non-Detects >Sediment SL
Metals (mg/kg)									
Arsenic	13	14	14	9.36	No exceedance	1.85	57	0	0
Cadmium	13	14	14	0.72	No exceedance	0.05	2.7	0	0
Chromium	13	14	14	39.7	No exceedance	7.72	63.5	0	0
Copper	13	14	14	93.3	No exceedance	7.64	270	0	0
Lead	13	14	14	198	No exceedance	2.53	360	0	0
Mercury	13	14	13	0.263	No exceedance	0.00926	0.41	0	0
Silver	13	14	14	0.23	No exceedance	0.03	3	0	0
Zinc	13	14	14	236	No exceedance	26.2	410	0	0
Volatile Organics (µg/kg)									
1,1,1,2-tetrachloroethane	2	4	0	--	--	--	--	0	0
1,1,1-trichloroethane	2	4	0	--	--	--	--	0	0
1,1,2,2-tetrachloroethane	2	4	0	--	--	--	--	0	0
1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113)	2	4	0	--	--	--	--	0	0
1,1,2-trichloroethane	2	4	0	--	--	--	--	0	0
1,1-dichloroethane	2	4	0	--	--	--	--	0	0
1,1-dichloroethene	2	4	0	--	--	--	--	0	0
1,1-dichloropropene	2	4	0	--	--	--	--	0	0
1,2,3-trichlorobenzene	2	4	0	--	--	--	--	0	0
1,2,3-trichloropropane	2	4	0	--	--	--	--	0	0
1,2,4-trichlorobenzene	2	4	0	--	--	--	31	0	1
1,2,4-trimethylbenzene	2	4	0	--	--	--	--	0	0
1,2-dibromo-3-chloropropane	2	4	0	--	--	--	--	0	0
1,2-dichlorobenzene	2	4	0	--	--	--	35	0	0
1,2-dichloroethane	2	4	0	--	--	--	--	0	0
1,2-dichloroethene, cis-	2	4	1	2.06	--	2.06	--	0	0
1,2-dichloroethene, trans-	2	4	0	--	--	--	--	0	0
1,2-dichloropropane	2	4	0	--	--	--	--	0	0
1,3,5-trimethylbenzene (Mesitylene)	2	4	0	--	--	--	--	0	0
1,3-dichlorobenzene	2	4	0	--	--	--	--	0	0
1,3-dichloropropane	2	4	0	--	--	--	--	0	0
1,3-dichloropropene, cis-	2	4	0	--	--	--	--	0	0
1,3-dichloropropene, trans-	2	4	0	--	--	--	--	0	0
1,4-dichloro-2-butene, trans-	2	4	0	--	--	--	--	0	0
1,4-dichlorobenzene	2	4	0	--	--	--	110	0	0
2-chloroethylvinyl ether	2	4	0	--	--	--	--	0	0
2-chlorotoluene	2	4	0	--	--	--	--	0	0
2-hexanone (Methyl butyl ketone)	2	4	0	--	--	--	--	0	0
2-pentanone	2	4	0	--	--	--	--	0	0
4-chlorotoluene	2	4	0	--	--	--	--	0	0
4-methyl-2-pentanone (methyl isobutyl ketone)	2	4	0	--	--	--	--	0	0
Acetone	2	4	3	3,150	--	32.8	--	0	0
Acrolein	2	4	0	--	--	--	--	0	0
Acrylonitrile	2	4	0	--	--	--	--	0	0
Benzene	2	4	1	7.08	--	7.08	--	0	0
Bromobenzene	2	4	0	--	--	--	--	0	0
Bromochloromethane	2	4	0	--	--	--	--	0	0
Bromodichloromethane	2	4	0	--	--	--	--	0	0
Bromoform (tribromomethane)	2	4	0	--	--	--	--	0	0
Bromomethane (methyl bromide)	2	4	0	--	--	--	--	0	0
Carbon disulfide	2	4	3	24.4	--	5.68	--	0	0
Carbon tetrachloride (tetrachloromethane)	2	4	0	--	--	--	--	0	0
Chlorobenzene	2	4	0	--	--	--	--	0	0
Chloroethane	2	4	0	--	--	--	--	0	0
Chloroform	2	4	0	--	--	--	--	0	0
Chloromethane	2	4	0	--	--	--	--	0	0
Cymene, p- (4-isopropyltoluene)	2	4	4	72,900	--	1.22	--	0	0

Table 2-3
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Analyte	Number of Locations	Number of Samples	Number of Detections	Maximum Detected Result	Maximum Exceedance Ratio	Minimum Detected Result	Sediment SL	Number of Detections >Sediment SL[1]	Number of Non-Detects >Sediment SL
Dibromochloromethane	2	4	0	--	--	--	--	0	0
Dibromomethane	2	4	0	--	--	--	--	0	0
Dichlorodifluoromethane	2	4	0	--	--	--	--	0	0
Dichloromethane (methylene chloride)	2	4	0	--	--	--	--	0	0
Ethyl bromide (bromoethane)	2	4	0	--	--	--	--	0	0
Ethylbenzene	2	4	0	--	--	--	--	0	0
Ethylene dibromide (1,2-dibromoethane)	2	4	0	--	--	--	--	0	0
Hexachlorobutadiene (hexachloro-1,3-butadiene)	6	11	0	--	--	--	11	0	3
Isopropylbenzene (cumene)	2	4	0	--	--	--	--	0	0
m,p-xylene	2	4	0	--	--	--	--	0	0
Methyl ethyl ketone (2-butanone)	2	4	1	124	--	124	--	0	0
Methyl iodide (iodomethane)	2	4	0	--	--	--	--	0	0
Methyl tert-butyl ether (MTBE)	2	4	0	--	--	--	--	0	0
n-butylbenzene	2	4	0	--	--	--	--	0	0
n-propylbenzene	2	4	0	--	--	--	--	0	0
Naphthalene	2	4	1	21.3	No exceedance	21.3	2,100	0	0
o-xylene	2	4	0	--	--	--	--	0	0
sec-butylbenzene	2	4	0	--	--	--	--	0	0
Styrene	2	4	0	--	--	--	--	0	0
tert-butylbenzene	2	4	0	--	--	--	--	0	0
Tetrachloroethene (PCE)	2	4	0	--	--	--	--	0	0
Toluene	2	4	2	19.9	--	1.6	--	0	0
Trichloroethene (TCE)	2	4	0	--	--	--	--	0	0
Trichlorofluoromethane (Fluorotrichloromethane)	2	4	0	--	--	--	--	0	0
Vinyl acetate	2	4	0	--	--	--	--	0	0
Vinyl chloride	2	4	0	--	--	--	--	0	0
Volatile Organics (mg/kg-OC)									
Hexachlorobutadiene (hexachloro-1,3-butadiene)	7	7	0	--	--	--	3.9	0	0
Semivolatile Organics (µg/kg)									
1,2,4-trichlorobenzene	6	7	0	--	--	--	31	0	0
1,2-dichlorobenzene	6	7	0	--	--	--	35	0	0
1,4-dichlorobenzene	6	7	2	6.2	No exceedance	4.5	110	0	0
2,4-dimethylphenol	13	14	4	5.6	No exceedance	2.8	29	0	2
2-methylphenol (o-Cresol)	13	14	3	5.2	No exceedance	2.6	63	0	0
4-methylphenol (p-Cresol)	13	14	9	510	4.6	2.7	110	1	0
Benzoic acid	13	14	8	1,330	2.1	20.8	650	1	0
Benzyl alcohol	13	14	2	120	2.1	7.1	57	1	2
Bis(2-ethylhexyl)phthalate	6	7	2	243	No exceedance	56.5	1,300	0	0
Butylbenzyl phthalate	6	7	0	--	--	--	63	0	0
Di-n-butyl phthalate	6	7	3	152	No exceedance	70.6	1,400	0	0
Di-n-octyl phthalate	6	7	1	46.6	No exceedance	46.6	61	0	0
Diethyl phthalate	6	7	1	358	1.8	358	200	1	0
Dimethyl phthalate	6	7	0	--	--	--	71	0	0
Hexachlorobenzene	6	7	0	--	--	--	22	0	0
n-nitrosodiphenylamine	6	7	0	--	--	--	28	0	0
Pentachlorophenol	13	14	4	9.2	No exceedance	3.2	360	0	0
Phenol	13	14	0	--	--	--	180	0	0
Semivolatile Organics (mg/kg-OC)									
1,2,4-trichlorobenzene	7	7	1	0.456	No exceedance	0.456	0.81	0	3
1,2-dichlorobenzene	7	7	0	--	--	--	2.3	0	0
1,4-dichlorobenzene	7	7	1	0.427	No exceedance	0.427	3.1	0	0
Bis(2-ethylhexyl)phthalate	7	7	3	7.83	No exceedance	4.31	47	0	0
Butylbenzyl phthalate	7	7	0	--	--	--	4.9	0	1
Di-n-butyl phthalate	7	7	4	34.5	No exceedance	6.53	220	0	0
Di-n-octyl phthalate	7	7	0	--	--	--	58	0	0
Diethyl phthalate	7	7	0	--	--	--	61	0	0
Dimethyl phthalate	7	7	2	0.319	No exceedance	0.209	53	0	0

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Hexachlorobenzene	7	7	0	--	--	--	0.38	0	5
n-Nitrosodiphenylamine	7	7	1	1.73	No exceedance	1.73	11	0	0
Polycyclic Aromatic Hydrocarbons (µg/kg)									
2-methylnaphthalene	7	8	7	197	No exceedance	5.8	670	0	0
Acenaphthene	7	8	8	426	No exceedance	8.4	500	0	0
Acenaphthylene	7	8	3	170	No exceedance	15.8	1,300	0	0
Anthracene	7	8	8	913	No exceedance	8.2	960	0	0
Benzo(a)anthracene	7	8	8	923	No exceedance	7.2	1,300	0	0
Benzo(a)pyrene	7	8	6	853	No exceedance	17.2	1,600	0	0
Benzo(b,j,k)fluoranthenes	7	8	7	1,220	No exceedance	10.2	3,200	0	0
Benzo(g,h,i)perylene	7	8	6	303	No exceedance	13.8	670	0	0
Chrysene	7	8	8	947	No exceedance	8.8	1,400	0	0
Dibenzo(a,h)anthracene	6	7	5	94	No exceedance	2.9	230	0	0
Dibenzofuran	6	7	7	136	No exceedance	8.1	540	0	0
Fluoranthene	7	8	8	2,330	1.4	29	1,700	1	0
Fluorene	7	8	8	480	No exceedance	8.7	540	0	0
Indeno(1,2,3-c,d)pyrene	7	8	6	297	No exceedance	9.6	600	0	0
Naphthalene	7	8	8	401	No exceedance	7	2,100	0	0
Phenanthrene	7	8	8	3,810	2.6	32.1	1,500	1	0
Pyrene	7	8	8	2,480	No exceedance	26.9	2,600	0	0
Total cPAH TEQ (U = 1/2)[2]	13	15	15	1,189	--	13.7	--	0	0
Total benzofluoranthenes (b,j,k) (U = 0)	7	8	7	1,220	No exceedance	10.2	3,200	0	0
Total cPAH TEQ (U = 0)[2]	13	15	15	1,189	--	1.082	--	0	0
Total HPAH (U = 0)	7	8	8	9,447	No exceedance	82.1	12,000	0	0
Total LPAH (U = 0)	7	8	8	5,756	1.1	88.6	5,200	1	0
Total PAH (U = 0)	13	15	15	15,400	15.4	110	1,000	7	0
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)									
2-methylnaphthalene	7	7	4	3.71	No exceedance	1.00	38	0	0
Acenaphthene	7	7	5	12.8	No exceedance	1.13	16	0	0
Acenaphthylene	7	7	3	4.05	No exceedance	1.24	66	0	0
Anthracene	7	7	6	28.0	No exceedance	1.26	220	0	0
Benzo(a)anthracene	7	7	7	68.9	No exceedance	1.02	110	0	0
Benzo(a)pyrene	7	7	7	76.8	No exceedance	1.74	99	0	0
Benzo(b,j,k)fluoranthenes	7	7	7	135	No exceedance	4.45	230	0	0
Benzo(g,h,i)perylene	7	7	6	25.8	No exceedance	1.24	31	0	0
Chrysene	7	7	7	87.2	No exceedance	2.72	110	0	0
Dibenzo(a,h)anthracene	7	7	6	10.7	No exceedance	0.573	12	0	0
Dibenzofuran	7	7	5	9.77	No exceedance	0.851	15	0	0
Fluoranthene	7	7	7	173	1.1	1.33	160	1	0
Fluorene	7	7	5	22.4	No exceedance	0.855	23	0	0
Indeno(1,2,3-c,d)pyrene	7	7	5	28.6	No exceedance	1.54	34	0	0
Naphthalene	7	7	5	7.56	No exceedance	1.72	99	0	0
Phenanthrene	7	7	7	125	1.3	1.82	100	3	0
Pyrene	7	7	7	172	No exceedance	2.82	1000	0	0
Total benzofluoranthenes (b,j,k) (U = 0)	7	7	7	135	No exceedance	4.45	230	0	0
Total HPAH (U = 0)	7	7	7	778	No exceedance	19.7	960	0	0
Total LPAH (U = 0)	7	7	7	180	No exceedance	1.82	370	0	0
Dioxins and Furans (ng/kg)									
2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)	13	14	10	16.4	--	0.158	--	0	0
1,2,3,7,8-pentachlorodibenzo-p-dioxin (PeCDD)	13	14	11	223	--	0.184	--	0	0
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin (HxCDD)	13	14	10	236	--	0.212	--	0	0
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin (HxCDD)	13	14	12	2,130	--	0.333	--	0	0
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin (HxCDD)	13	14	11	1,100	--	0.209	--	0	0
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin (HpCDD)	13	14	14	9,150	--	0.284	--	0	0
1,2,3,4,6,7,8,9-octachlorodibenzo-p-dioxin (OCDD)	13	14	14	8,910	--	1.88	--	0	0
Total tetrachlorodibenzo-p-dioxin (TCDD)	13	14	13	3,640	--	0.629	--	0	0
Total pentachlorodibenzo-p-dioxin (PeCDD)	13	14	13	7,000	--	0.212	--	0	0

Table 2-3
Summary of Existing Soil Data Detections and Exceedances

Analyte	Number of Locations	Number of Samples	Number of Detections	Maximum Detected Result	Maximum Exceedance Ratio	Minimum Detected Result	Sediment SL	Number of Detections >Sediment SL[1]	Number of Non-Detects >Sediment SL
Total hexachlorodibenzo-p-dioxin (HxCDD)	13	14	14	21,100	--	0.145	--	0	0
Total heptachlorodibenzo-p-dioxin (HpCDD)	13	14	14	16,500	--	0.581	--	0	0
2,3,7,8-tetrachlorodibenzofuran (TCDF)	13	14	12	46	--	0.134	--	0	0
1,2,3,7,8-pentachlorodibenzofuran (PeCDF)	13	14	10	54.1	--	0.156	--	0	0
2,3,4,7,8-pentachlorodibenzofuran (PeCDF)	13	14	12	108	--	0.141	--	0	0
1,2,3,4,7,8-hexachlorodibenzofuran (HxCDF)	13	14	11	1,380	--	0.281	--	0	0
1,2,3,6,7,8-hexachlorodibenzofuran (HxCDF)	13	14	11	488	--	0.225	--	0	0
1,2,3,7,8,9-hexachlorodibenzofuran (HxCDF)	13	14	9	613	--	0.41	--	0	0
2,3,4,6,7,8-hexachlorodibenzofuran (HxCDF)	13	14	10	531	--	0.272	--	0	0
1,2,3,4,6,7,8-heptachlorodibenzofuran (HpCDF)	13	14	13	1,570	--	0.266	--	0	0
1,2,3,4,7,8,9-heptachlorodibenzofuran (HpCDF)	13	14	11	891	--	0.119	--	0	0
1,2,3,4,6,7,8,9-octachlorodibenzofuran (OCDF)	13	14	13	3,130	--	0.668	--	0	0
Total tetrachlorodibenzofuran (TCDF)	13	14	13	2,850	--	1.58	--	0	0
Total pentachlorodibenzofuran (PeCDF)	13	14	13	5,530	--	0.442	--	0	0
Total hexachlorodibenzofuran (HxCDF)	13	14	13	7,100	--	0.461	--	0	0
Total heptachlorodibenzofuran (HpCDF)	13	14	13	5,000	--	1.03	--	0	0
Total doxin/furan TEQ (mammal; U = 1/2)	13	14	14	1,046	41.8	0.118	25	3	0
Total dioxin/furan TEQ (mammal; U = 0)	13	14	14	1,046	41.8	0.003	25	3	0
PCB Aroclors (µg/kg)									
Aroclor 1016	18	36	0	--	--	--	--	0	0
Aroclor 1221	18	36	0	--	--	--	--	0	0
Aroclor 1232	18	36	0	--	--	--	--	0	0
Aroclor 1242	18	36	0	--	--	--	--	0	0
Aroclor 1248	18	36	13	312,000	--	3.4	--	0	0
Aroclor 1254	18	36	34	292,000	--	1.6	--	0	0
Aroclor 1260	18	36	30	40,300	--	1.4	--	0	0
Aroclor 1262	18	36	0	--	--	--	--	0	0
Aroclor 1268	18	36	0	--	--	--	--	0	0
Total PCB aroclors (U = 0)	13	23	22	644,300	5,034	3	128	16	0
PCB Aroclors (mg/kg-OC)									
Total PCB aroclors (U = 0)	13	13	13	5,578	465	0.667	12	9	0

Notes:
1. Locations may have multiple sample intervals; therefore, there may be multiple SL exceedances at the same location.
2. Total cPAH TEQ was calculated using compound-specific potency factors consistent with the EW SRI (Windward and Anchor QEA 2014).
U = 1/2: totals are calculated as the sum of all detected results and half of the reporting limit of nondetect results. If all results are not detected, the highest limit value is reported as the sum.
U = 0: totals are calculated as the sum of all detected results. If all results are not detected, the highest limit value is reported as the sum.
--: not applicable
µg/kg: micrograms per kilogram
cPAH: carcinogenic polycyclic aromatic hydrocarbon
DDD: dichlorodiphenyldichloroethane
DDE: dichlorodiphenyldichloroethylene
DDT: dichlorodiphenyltrichloroethane
EW: East Waterway
HPAH: high-molecular-weight polycyclic aromatic hydrocarbon
LPAH: low-molecular-weight polycyclic aromatic hydrocarbon
mg/kg: milligrams per kilogram
mg/kg-OC: milligrams per kilogram-organic carbon
ng/kg: nanograms per kilogram
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
SL: screening level
SRI: Supplemental Remedial Investigation
TEQ: toxic equivalency quotient

Table 2-4
Summary of Existing Sediment Data Detections and Exceedances

Analyte	Number of Locations	Number of Samples	Number of Detections	Maximum Detected Result	Maximum Exceedance Ratio	Minimum Detected Result	Sediment SL	Number of Detections >Sediment SL[1]	Number of Non-Detects >Sediment SL
Metals (mg/kg)									
Antimony	16	22	0	--	--	--	--	0	0
Arsenic	46	99	98	31.9	No exceedance	1.11	57	0	0
Cadmium	46	100	77	6.96	2.6	0.04	2.7	18	0
Chromium	46	99	99	165	2.6	7.21	63.5	12	0
Cobalt	16	22	22	16.4	--	4	--	0	0
Copper	46	99	99	202	No exceedance	6.8	270	0	0
Lead	46	99	97	3,490	9.7	0.94	360	5	0
Mercury	46	118	108	2.35	5.7	0.00541	0.41	36	0
Molybdenum	16	22	18	9	--	1	--	0	0
Nickel	18	26	25	62	--	7	--	0	0
Selenium	16	22	2	1	--	1	--	0	0
Silver	45	97	82	12.1	4.0	0.03	3	12	0
Thallium	16	22	1	0.5	--	0.5	--	0	0
Vanadium	16	22	22	84.3	--	24	--	0	0
Zinc	46	99	99	1,380	3.4	16.9	410	7	0
Organometallic Compounds (µg/kg)									
Butyltin (ion)	3	4	1	7.6	--	7.6	--	0	0
Dibutyltin (ion)	3	4	2	22	--	15	--	0	0
Tributyltin (ion)	4	5	2	63	No exceedance	4.5	102	0	0
Organometallic Compounds (mg/kg-OC)									
Tributyltin (ion)	5	7	5	8.52	1.1	0.194	7.5	1	0
Volatile Organics (µg/kg)									
Hexachlorobutadiene (hexachloro-1,3-butadiene)	23	50	1	4.4	No exceedance	4.4	11	0	10
Volatile Organics (mg/kg-OC)									
Hexachlorobutadiene (hexachloro-1,3-butadiene)	34	57	0	--	--	--	3.9	0	0
Semivolatile Organics (µg/kg)									
1,2,4-trichlorobenzene	24	52	11	190	6.1	2.7	31	2	4
1,2-dichlorobenzene	24	52	7	5.1	No exceedance	0.9	35	0	4
1,3-dichlorobenzene	18	29	0	--	--	--	--	0	0
1,4-dichlorobenzene	24	52	23	2,300	20.9	1.1	110	2	0
2,2'-oxybis (2-chloropropane)	16	25	0	--	--	--	--	0	0
2,4,5-trichlorophenol	16	25	0	--	--	--	--	0	0
2,4,6-trichlorophenol	16	25	0	--	--	--	--	0	0
2,4-dichlorophenol	16	25	0	--	--	--	--	0	0
2,4-dimethylphenol	46	110	44	76.1	2.6	2.2	29	3	16
2,4-dinitrophenol	16	25	0	--	--	--	--	0	0
2,4-dinitrotoluene	17	26	0	--	--	--	--	0	0
2,6-dinitrotoluene	17	26	0	--	--	--	--	0	0
2-chloronaphthalene	16	25	0	--	--	--	--	0	0
2-chlorophenol	16	25	0	--	--	--	--	0	0
2-methylphenol (o-cresol)	46	111	34	28.2	No exceedance	1.2	63	0	3
2-nitroaniline	16	25	0	--	--	--	--	0	0
2-nitrophenol	16	25	0	--	--	--	--	0	0
3,3'-dichlorobenzidine	16	25	0	--	--	--	--	0	0
3-nitroaniline	16	25	0	--	--	--	--	0	0
4-bromophenyl-phenyl ether	16	25	0	--	--	--	--	0	0
4-chloro-3-methylphenol	16	25	0	--	--	--	--	0	0
4-chloroaniline	16	25	0	--	--	--	--	0	0
4-chlorophenyl phenyl ether	16	25	0	--	--	--	--	0	0
4-methylphenol (p-cresol)	46	111	79	572	5.2	1.1	110	11	2

Table 2-4
Summary of Existing Sediment Data Detections and Exceedances

Analyte	Number of Locations	Number of Samples	Number of Detections	Maximum Detected Result	Maximum Exceedance Ratio	Minimum Detected Result	Sediment SL	Number of Detections >Sediment SL[1]	Number of Non-Detects >Sediment SL
4-nitroaniline	16	25	0	--	--	--	--	0	0
4-nitrophenol	16	25	0	--	--	--	--	0	0
Aniline	16	25	0	--	--	--	--	0	0
Benzoic acid	46	107	20	281	No exceedance	13.5	650	0	4
Benzyl alcohol	46	111	17	36.3	No exceedance	2.5	57	0	23
Bis(2-chloroethoxy)methane	16	25	0	--	--	--	--	0	0
Bis(2-chloroethyl)ether	16	25	0	--	--	--	--	0	0
Bis(2-ethylhexyl)phthalate	24	52	20	2,640	2.0	8	1,300	5	0
Butylbenzyl phthalate	24	52	4	76	1.2	47	63	1	5
Di-n-butyl phthalate	24	52	6	104	No exceedance	8.9	1,400	0	0
Di-n-octyl phthalate	24	52	5	191	3.1	54.2	61	4	6
Diethyl phthalate	24	52	13	86.4	No exceedance	7.3	200	0	2
Dimethyl phthalate	24	52	5	49.1	No exceedance	13.4	71	0	2
Dinitro-o-cresol (4,6-dinitro-2-methylphenol)	16	25	0	--	--	--	--	0	0
Hexachlorobenzene	24	52	0	--	--	--	22	0	8
Hexachlorobutadiene (hexachloro-1,3-butadiene)	1	2	0	--	--	--	11	0	2
Hexachlorocyclopentadiene	16	25	0	--	--	--	--	0	0
Hexachloroethane	17	27	0	--	--	--	--	0	0
Isophorone	16	25	0	--	--	--	--	0	0
n-nitrosodi-n-propylamine	16	25	1	34	--	34	--	0	0
n-nitrosodimethylamine	16	25	0	--	--	--	--	0	0
n-nitrosodiphenylamine	24	52	8	193	6.9	17.3	28	6	5
Nitrobenzene	16	25	0	--	--	--	--	0	0
Pentachlorophenol	46	111	37	480	1.3	2.2	360	1	2
Phenol	46	111	56	270	1.5	3.1	180	3	1
Semivolatile Organics (mg/kg-OC)									
1,2,4-trichlorobenzene	36	59	10	0.962	1.2	0.216	0.81	1	12
1,2-dichlorobenzene	36	59	2	0.071	No exceedance	0.069	2.3	0	2
1,4-dichlorobenzene	36	59	19	8.79	2.8	0.132	3.1	1	2
Bis(2-ethylhexyl)phthalate	36	59	37	136	2.9	0.638	47	7	0
Butylbenzyl phthalate	36	59	15	9.01	1.8	0.775	4.9	1	1
Di-n-butyl phthalate	36	59	5	3.74	No exceedance	0.274	220	0	0
Di-n-octyl phthalate	36	59	3	3.33	No exceedance	0.663	58	0	0
Diethyl phthalate	36	59	5	2.85	No exceedance	0.738	61	0	0
Dimethyl phthalate	36	59	6	23.9	No exceedance	0.119	53	0	0
Hexachlorobenzene	34	57	1	0.228	No exceedance	0.228	0.38	0	26
n-nitrosodiphenylamine	36	59	4	0.927	No exceedance	0.514	11	0	0
Polycyclic Aromatic Hydrocarbons (µg/kg)									
1-methylnaphthalene	16	26	10	2700	--	15	--	0	0
2-methylnaphthalene	26	61	42	2390	3.6	5.1	670	3	0
Acenaphthene	26	61	44	8,620	17.2	8.2	500	14	0
Acenaphthylene	26	61	35	460	No exceedance	18	1,300	0	0
Anthracene	26	61	42	6,450	6.7	11.4	960	16	0
Benzo(a)anthracene	25	60	42	6,050	4.7	9.7	1,300	14	0
Benzo(a)pyrene	25	60	44	3,260	2.0	4.3	1,600	9	0
Benzo(b)fluoranthene	13	16	16	5,400	--	56	--	0	0
Benzo(b,j,k)fluoranthenes	20	50	35	6,620	2.1	17.6	3,200	7	0
Benzo(g,h,i)perylene	26	61	38	2,690	4.0	70.6	670	7	0
Benzo(k)fluoranthene	13	16	16	5,400	--	60	--	0	0
Carbazole	16	25	18	2,200	--	15	--	0	0
Chrysene	25	59	43	8,100	5.8	6.1	1,400	19	0
Dibenzo(a,h)anthracene	26	61	41	727	3.2	1.2	230	9	0

Table 2-4
Summary of Existing Sediment Data Detections and Exceedances

Analyte	Number of Locations	Number of Samples	Number of Detections	Maximum Detected Result	Maximum Exceedance Ratio	Minimum Detected Result	Sediment SL	Number of Detections >Sediment SL[1]	Number of Non-Detects >Sediment SL
Dibenzofuran	26	58	34	4,480	8.3	23.4	540	6	0
Fluoranthene	25	59	45	33,900	19.9	8.3	1,700	27	0
Fluorene	26	61	40	5,540	10.3	17	540	13	0
Indeno(1,2,3-c,d)pyrene	26	61	38	2,170	3.6	59.8	600	7	0
Naphthalene	26	61	49	44,100	21.0	4.8	2,100	3	0
Phenanthrene	25	59	44	10,600	7.1	11.3	1,500	15	0
Pyrene	26	61	52	21,700	8.4	6.3	2,600	21	0
Total benzofluoranthenes (laboratory-reported total)	4	8	5	4,400	1.4	600	3,200	1	0
Total cPAH TEQ (U = 1/2)[2]	46	126	108	10,346	--	9.38	--	0	0
Total benzofluoranthenes (b,j,k) (U = 0)	25	60	42	6,620	2.1	17.6	3,200	10	0
Total cPAH TEQ (U = 0)[2]	46	126	108	10,346	--	0.061	--	0	0
Total HPAH (U = 0)	26	61	52	80,062	6.7	6.3	12,000	16	0
Total LPAH (U = 0)	26	61	49	71,721	13.8	4.8	5,200	13	0
Total PAH (U = 0)	46	126	117	154,173	154	4.8	1,000	94	0
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)									
2-methylnaphthalene	38	65	47	200	5.3	0.257	38	3	0
Acenaphthene	38	65	53	462	28.9	0.697	16	15	0
Acenaphthylene	38	65	44	25.7	No exceedance	0.338	66	0	0
Anthracene	38	65	61	1,307	5.9	0.851	220	2	0
Benzo(a)anthracene	38	65	61	1,147	10.4	1.10	110	3	0
Benzo(a)pyrene	38	64	58	1,243	12.6	0.466	99	3	0
Benzo(b,j,k)fluoranthenes	22	42	39	1,845	8.0	1.15	230	1	0
Benzo(g,h,i)perylene	38	65	52	860	27.8	1.11	31	3	0
Chrysene	38	64	60	1,205	11.0	1.23	110	4	0
Dibenzo(a,h)anthracene	38	65	55	193	16.1	0.098	12	3	0
Dibenzofuran	38	64	46	286	19.1	0.809	15	8	0
Fluoranthene	38	64	61	3,914	24.5	3.70	160	7	0
Fluorene	38	65	54	500	21.7	0.861	23	11	0
Indeno(1,2,3-c,d)pyrene	38	65	51	662	19.5	1.34	34	3	0
Naphthalene	38	65	52	497	5.0	0.446	99	3	0
Phenanthrene	38	64	61	4,466	44.7	1.33	100	7	0
Pyrene	38	65	63	3,810	3.8	3.39	1000	1	0
Total benzofluoranthenes (laboratory-reported total)	4	8	8	48.3	No exceedance	3.05	230	0	0
Total benzofluoranthenes (b,j,k) (U = 0)	38	64	61	1,845	8.0	1.15	230	2	0
Total HPAH (U = 0)	38	65	63	14,879	15.5	7.09	960	4	0
Total LPAH (U = 0)	38	65	62	6,703	18.1	3.32	370	5	0
Pesticides (µg/kg)									
2,4'-DDD (o,p'-DDD)	7	7	0	--	--	--	--	0	0
2,4'-DDE (o,p'-DDE)	7	7	0	--	--	--	--	0	0
2,4'-DDT (o,p'-DDT)	7	7	0	--	--	--	--	0	0
4,4'-DDD (p,p'-DDD)	12	14	0	--	--	--	--	0	0
4,4'-DDE (p,p'-DDE)	12	14	0	--	--	100	--	0	0
4,4'-DDT (p,p'-DDT)	12	14	0	--	--	--	--	0	0
Aldrin	7	7	0	--	--	--	--	0	0
Chlordane, alpha- (Chlordane, cis-)	7	7	0	--	--	--	--	0	0
Chlordane, beta- (Chlordane, trans-)	5	5	0	--	--	--	--	0	0
Chlordane, gamma-	2	2	0	--	--	--	--	0	0
Dieldrin	7	7	0	--	--	--	--	0	0
Endosulfan sulfate	2	2	0	--	--	--	--	0	0
Endosulfan, alpha- (I)	2	2	0	--	--	--	--	0	0
Endosulfan, beta (II)	2	2	0	--	--	--	--	0	0
Endrin	2	2	0	--	--	--	--	0	0

Table 2-4
Summary of Existing Sediment Data Detections and Exceedances

Analyte	Number of Locations	Number of Samples	Number of Detections	Maximum Detected Result	Maximum Exceedance Ratio	Minimum Detected Result	Sediment SL	Number of Detections >Sediment SL[1]	Number of Non-Detects >Sediment SL
Endrin aldehyde	2	2	0	--	--	--	--	0	0
Endrin ketone	7	7	0	--	--	--	--	0	0
Heptachlor	7	7	0	--	--	--	--	0	0
Heptachlor epoxide	2	2	0	--	--	--	--	0	0
Hexachlorocyclohexane (BHC), alpha-	2	2	0	--	--	--	--	0	0
Hexachlorocyclohexane (BHC), beta-	2	2	0	--	--	--	--	0	0
Hexachlorocyclohexane (BHC), delta-	2	2	0	--	--	--	--	0	0
Hexachlorocyclohexane (BHC), gamma- (lindane)	2	2	0	--	--	--	--	0	0
Methoxychlor	2	2	0	--	--	--	--	0	0
Mirex	2	2	0	--	--	--	--	0	0
Nonachlor, cis-	7	7	0	--	--	--	--	0	0
Nonachlor, trans-	7	7	1	4.4	--	4.4	--	0	0
Oxychlordane	7	7	0	--	--	--	--	0	0
Toxaphene	2	2	0	--	--	--	--	0	0
Sum DDD (U = 0)	12	14	0	--	--	--	16	0	0
Sum DDE (U = 0)	12	14	0	--	--	--	9	0	2
Sum DDT (U = 0)	12	14	0	--	--	--	12	0	1
Pesticides (mg/kg-OC)									
Hexachlorobenzene	2	2	0	--	--	--	0.38	0	0
Hexachlorobutadiene (hexachloro-1,3-butadiene)	2	2	0	--	--	--	3.9	0	0
Dioxins and Furans (ng/kg)									
2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)	31	86	37	12.4	--	0.165	--	0	0
1,2,3,7,8-pentachlorodibenzo-p-dioxin (PeCDD)	31	86	48	144	--	0.298	--	0	0
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin (HxCDD)	31	86	45	137	--	0.3	--	0	0
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin (HxCDD)	31	86	53	1,500	--	0.213	--	0	0
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin (HxCDD)	31	86	59	584	--	0.178	--	0	0
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin (HpCDD)	31	85	57	27,000	--	1.73	--	0	0
1,2,3,4,6,7,8,9-octachlorodibenzo-p-dioxin (OCDD)	31	85	53	160,000	--	11.6	--	0	0
Total tetrachlorodibenzo-p-dioxin (TCDD)	31	86	70	734	--	0.302	--	0	0
Total pentachlorodibenzo-p-dioxin (PeCDD)	31	86	57	1,370	--	0.189	--	0	0
Total hexachlorodibenzo-p-dioxin (HxCDD)	31	86	71	11,000	--	0.178	--	0	0
Total heptachlorodibenzo-p-dioxin (HpCDD)	31	86	85	51,500	--	1.25	--	0	0
2,3,7,8-tetrachlorodibenzofuran (TCDF)	31	86	58	1,150	--	0.109	--	0	0
1,2,3,7,8-pentachlorodibenzofuran (PeCDF)	31	86	58	35.7	--	0.092	--	0	0
2,3,4,7,8-pentachlorodibenzofuran (PeCDF)	31	86	57	132	--	0.154	--	0	0
1,2,3,4,7,8-hexachlorodibenzofuran (HxCDF)	31	86	53	507	--	0.107	--	0	0
1,2,3,6,7,8-hexachlorodibenzofuran (HxCDF)	31	86	54	206	--	0.161	--	0	0
1,2,3,7,8,9-hexachlorodibenzofuran (HxCDF)	31	86	39	250	--	0.207	--	0	0
2,3,4,6,7,8-hexachlorodibenzofuran (HxCDF)	31	86	52	328	--	0.146	--	0	0
1,2,3,4,6,7,8-heptachlorodibenzofuran (HpCDF)	31	85	52	8,850	--	0.402	--	0	0
1,2,3,4,7,8,9-heptachlorodibenzofuran (HpCDF)	31	86	44	401	--	0.207	--	0	0
1,2,3,4,6,7,8,9-octachlorodibenzofuran (OCDF)	31	85	52	50,500	--	0.302	--	0	0
Total tetrachlorodibenzofuran (TCDF)	31	86	64	5,820	--	0.096	--	0	0
Total pentachlorodibenzofuran (PeCDF)	31	86	61	11,100	--	0.241	--	0	0
Total hexachlorodibenzofuran (HxCDF)	31	86	62	7,510	--	0.09	--	0	0
Total heptachlorodibenzofuran (HpCDF)	31	86	73	45,200	--	0.23	--	0	0
Total dioxin/furan TEQ (Mammal; U = 1/2)	31	86	68	885	35.4	0.220	25	28	0
Total dioxin/furan TEQ (Mammal; U = 0)	31	86	68	885	35.4	0.0199	25	28	0
PCB Aroclors (µg/kg)									
Aroclor 1016	46	119	0	--	--	--	--	0	0
Aroclor 1221	46	119	0	--	--	--	--	0	0
Aroclor 1232	46	119	0	--	--	--	--	0	0

Table 2-4
Summary of Existing Sediment Data Detections and Exceedances

Analyte	Number of Locations	Number of Samples	Number of Detections	Maximum Detected Result	Maximum Exceedance Ratio	Minimum Detected Result	Sediment SL	Number of Detections >Sediment SL[1]	Number of Non-Detects >Sediment SL
Aroclor 1242	46	119	6	430	--	7.5	--	0	0
Aroclor 1248	46	119	47	2,400	--	2.1	--	0	0
Aroclor 1254	46	119	83	4,490	--	1.6	--	0	0
Aroclor 1260	46	119	92	13,300	--	0.6	--	0	0
Aroclor 1262	43	113	2	101	--	19.6	--	0	0
Aroclor 1268	43	113	2	17.5	--	14.2	--	0	0
Total PCB aroclors (U = 0)	24	55	50	16,750	131	0.8	128	26	0
PCB Aroclors (mg/kg-OC)									
Total PCB aroclors (U = 0)	37	64	47	298	24.8	0.059	12	27	0
Total Petroleum Hydrocarbons (mg/kg)									
Diesel range hydrocarbons	2	2	2	554	--	221	--	0	0
Motor oil range hydrocarbons	2	2	2	1,120	--	345	--	0	0

Notes:
1. Locations may have multiple sample intervals; therefore, there may be multiple SL exceedances at the same location.
2. Total cPAH TEQ was calculated using compound-specific potency factors consistent with the EW SRI (Windward and Anchor QEA 2014)
U = 1/2: totals are calculated as the sum of all detected results and half of the reporting limit of nondetect results. If all results are not detected, the highest limit value is reported as the sum
U = 0: totals are calculated as the sum of all detected results. If all results are not detected, the highest limit value is reported as the sum
--: not applicable
µg/kg: micrograms per kilogram
cPAH: carcinogenic polycyclic aromatic hydrocarbon
DDD: dichlorodiphenyldichloroethane
DDE: dichlorodiphenyldichloroethylene
DDT: dichlorodiphenyltrichloroethane
EW: East Waterway
HPAH: high-molecular-weight polycyclic aromatic hydrocarbon
LPAH: low-molecular-weight polycyclic aromatic hydrocarbon
mg/kg: milligrams per kilogram
mg/kg-OC: milligrams per kilogram-organic carbon
ng/kg: nanograms per kilogram
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
SL: screening level
SRI: Supplemental Remedial Investigation
TEQ: toxic equivalents quotient

Table 3-1
Summary of Preliminary Contaminants of Potential Concern

Contaminant	Detected Above Sediment SL, or Nondetect Values Exceed SL		East Waterway OU COC[1]	Retained as Sitewide Preliminary COPC[2]
	Existing East Waterway Sediment Area	Future Sediment Area		
Metals				
Arsenic	No	No	Yes	Yes
Cadmium	Yes	No	Yes	Yes
Chromium	Yes	No	No	Yes
Copper	No	No	No	No
Lead	Yes	No	No	Yes
Mercury	Yes	No	Yes	Yes
Silver	Yes	No	No	Yes
Zinc	Yes	No	Yes	Yes
Volatile Organics				
Cymene, p- (4-isopropyltoluene)	No	No	No	Yes[4]
Organometallic Compounds				
Tributyltin (ion)	Yes	No data	Yes	Yes
Semivolatile Organics				
1,2,4-trichlorobenzene	Yes	Yes[3]	No	Yes
1,2-dichlorobenzene	Yes[3]	No	No	No
1,4-dichlorobenzene	Yes	No	Yes	Yes
2,4-dimethylphenol	Yes	Yes[3]	Yes	Yes
2-methylphenol (o-cresol)	Yes[3]	No	No	No
4-methylphenol (p-cresol)	Yes	Yes	No	Yes
Benzoic acid	Yes[3]	Yes	No	Yes
Benzyl alcohol	Yes[3]	Yes	No	Yes
Bis(2-ethylhexyl)phthalate	Yes	No	Yes	Yes
Butylbenzyl phthalate	Yes	Yes[3]	Yes	Yes
Di-n-butyl phthalate	No	No	Yes	Yes
Di-n-octyl phthalate	Yes	No	No	Yes
Diethyl phthalate	Yes[3]	Yes	No	Yes
Dimethyl phthalate	Yes[3]	No	No	No
Hexachlorobenzene	Yes[3]	Yes[3]	No	No
Hexachlorobutadiene (hexachloro-1,3-butadiene)	Yes[3]	Yes[3]	No	No
n-nitrosodiphenylamine	Yes	No	Yes	Yes
Pentachlorophenol	Yes	No	No	Yes
Phenol	Yes	No	Yes	Yes
Polycyclic Aromatic Hydrocarbons				
2-methylnaphthalene	Yes	No	Yes	Yes
Acenaphthene	Yes	No	Yes	Yes
Anthracene	Yes	No	Yes	Yes
Benzo(a)anthracene	Yes	No	Yes	Yes
Benzo(a)pyrene	Yes	No	Yes	Yes
Benzo(b,j,k)fluoranthenes	Yes	No	Yes	Yes
Benzo(g,h,i)perylene	Yes	No	Yes	Yes
Chrysene	Yes	No	Yes	Yes
Dibenzo(a,h)anthracene	Yes	No	Yes	Yes
Dibenzofuran	Yes	No	Yes	Yes
Fluoranthene	Yes	Yes	Yes	Yes
Fluorene	Yes	No	Yes	Yes
Indeno(1,2,3-c,d)pyrene	Yes	No	Yes	Yes
Naphthalene	Yes	No	No	Yes
Phenanthrene	Yes	Yes	Yes	Yes
Pyrene	Yes	No	Yes	Yes
Total benzofluoranthenes (b,j,k) (U = 0)	Yes	No	Yes	Yes
Total HPAH	Yes	No	Yes	Yes
Total LPAH	Yes	No	Yes	Yes
Total PAH	Yes	Yes	No	Yes
Total cPAH TEQ	No	No	Yes	Yes

Table 3-1
Summary of Preliminary Contaminants of Potential Concern

Contaminant	Detected Above Sediment SL, or Nondetect Values Exceed SL		East Waterway OU COC[1]	Retained as Sitewide Preliminary COPC[2]
	Existing East Waterway Sediment Area	Future Sediment Area		
Pesticides				
Sum DDD	No	No data	No	No
Sum DDE	Yes[3]	No data	No	No
Sum DDT	Yes[3]	No data	No	No
Dioxin and Furans				
Total dioxin/furan TEQ (mammal)	Yes	Yes	Yes	Yes
PCB Aroclors				
Total PCB aroclors	Yes	Yes	Yes	Yes

Notes:

Yellow highlighting indicates contaminant is identified as a preliminary COPC.

1. East Waterway OU COCs are Risk Driver COCs identified in the Final Feasibility Study (Anchor QEA and Windward 2019)
2. Sitewide preliminary COPCs are also considered preliminary COPCs for groundwater.
3. SL exceedance based on nondetect value.
4. 4-isopropyltoluene does not have an SL but is identified as a COPC due to high concentrations in two samples.

COC: contaminant of concern

COPC: contaminant of potential concern

cPAH: carcinogenic polycyclic aromatic hydrocarbon

DDD: dichlorodiphenyldichloroethane

DDE: dichlorodiphenyldichloroethylene

DDT: dichlorodiphenyltrichloroethane

HPAH: high-molecular-weight polycyclic aromatic hydrocarbon

LPAH: low-molecular-weight polycyclic aromatic hydrocarbon

OU: operating unit

PAH: polycyclic aromatic hydrocarbon

PCB: polychlorinated biphenyl

SL: screening level

TEQ: toxic equivalents quotient

Table 4-1
ARARs for the East Waterway

Topic	Threshold	Regulatory Citation		Comment
		Federal	State	
Soil, groundwater, surface water and air quality	Cleanup standards for multiple media	N/A	MTCA 70.105D RCW; WAC 173-340)	The MTCA established excess cancer risk standards, among other important standards.
Sediment quality	Sediment cleanup standards	N/A	SMS (WAC 173-204)	The SMS are promulgated rules under MTCA for excess human health cancer risk standards, non-cancer risk standards for human health and higher trophic-level species, and numerical criteria for the protection of the benthic community.
Surface water quality	Surface water quality standards	National Recommended Ambient Water Quality Criteria established under of CWA 304(a) (33 USC 1251 et seq.); water.epa.gov/scitech/swguidance/standards/criteria/index.cfm	Surface Water Quality Standards (RCW 90.48; WAC 173-201A) State Aquatic Life Criteria (National Toxics Rule 40 CFR 131.36(b)(1) as applied to Washington per 40 CFR 131.36(d)(14) State Human Health Criteria)	The National Recommended Federal Water Quality Criteria established under CWA 304(a) are relevant and appropriate. More stringent state surface water quality standards apply where the state has adopted, and EPA has approved, water quality standards. Both chronic and acute standards are used.
Land disposal of waste	Disposal of materials containing polychlorinated biphenyls	TSCA (15 USC 2605; 40 CFR Part 761)	N/A	Some Future Sediment Area soils contain PCBs above TSCA levels.
	Hazardous waste	RCRA Land Disposal Restrictions (42 USC 6901-92k)	Dangerous Waste Regulations Land Disposal Restrictions (RCW 70.105; WAC 173-303, -140, -141)	None has been found, to date, that exceed RCRA levels.
Waste treatment storage and disposal	Disposal limitations	RCRA (42 USC 6901-6992k; 40 CFR 260-279)	Dangerous Waste Regulations (RCW 70.105; WAC 173-303)	N/A
Noise	Maximum noise levels	N/A	Noise Control Act of 1974 (RCW 70.107; WAC 173-60)	N/A
Groundwater	Groundwater quality	Safe Drinking Water Act maximum contaminant levels and non-zero maximum contaminant level goals (40 CFR 141)	RCW 43.20A.165 and WAC 173-290-310	For on-site potable water, if any

Table 4-1
ARARs for the East Waterway

Topic	Threshold	Regulatory Citation		Comment
		Federal	State	
Dredge/fill and other in-water construction work	Discharge of dredged/fill material into navigable waters or wetlands	CWA 401, 404; 33 USC 1341-1344; 40 CFR 121.2, 230, 231; 33 CFR 320, 322-3, 328-30); Rivers and Harbors Act (33 USC 401 et seq.)	Hydraulic Code Rules (RCW 75.55; WAC 220-110)	For in-water dredging, filling, or other construction
	Open-water disposal of dredged sediments	Marine Protection, Research and Sanctuaries Act (33 USC 1401-1445; 40 CFR 227)	Dredged Material Management Program (RCW 79.105.500; WAC 332-30-166 (3))	N/A
Solid waste disposal	Requirements for solid waste handling, management, and disposal	Solid Waste Disposal Act (42 USC 6901-92k; 40 CFR 257, -258)	Solid Waste Handling Standards (RCW 70.95; WAC 173-350)	N/A
Discharge to surface water	Point source standards for new discharges to surface water	National Pollutant Discharge Elimination System (40 CFR 122, 125)	Discharge Permit Program (RCW 90.48; WAC 173-216, -222)	N/A
Shoreline	Construction and development	N/A	Shoreline Management Act (RCW 90.58; WAC 173-16)	For construction within 200 feet of the shoreline
Floodplain Protection	Avoidance of adverse impacts and minimization of potential harm	Executive Order 11988, Floodplain Management (40 CFR 6, Appendix A); Federal Emergency Management Agency National Flood Insurance Program Regulations (44 CFR 60.3(d)(3))	Growth Management Act critical areas	For in-water construction activities, including any dredge or fill operations; includes local ordinances: KCC Title 9 and SMC 25.09
Critical (or sensitive) area	Evaluation and mitigation of impacts	N/A	Growth Management Act (RCW 36.70A)	N/A
Habitat for fish, plants, or birds	Evaluation and mitigation of habitat impacts	CWA 404 (b)(1)); 1981 U.S. Fish and Wildlife Mitigation Policy (44 CFR 7644-7663)[1]; U.S. Fish and Wildlife Coordination Act (16 USC 661 et seq.); Migratory Bird Treaty Act (16 USC 703-712)	N/A	N/A
Pretreatment standards	National pretreatment standards	N/A	40 CFR Part 403; Metro District Wastewater Discharge Ordinance (KCC) to be considered (as a local requirement)[1]	N/A

Table 4-1
ARARs for the East Waterway

Topic	Threshold	Regulatory Citation		Comment
		Federal	State	
Native American graves and sacred sites	Evaluation and mitigation of impacts to cultural resources	Native American Graves Protection and Repatriation Act (25 USC 3001 et seq.; 43 CFR Part 10) and American Indian Religious Freedom Act (42 USC 1996 et seq.)	N/A	N/A
Critical habitat for endangered species	Conservation of endangered or threatened species; consultation with species listing agencies	Endangered Species Act of 1973 (16 USC 1531 et seq; 50 CFR 200, -402); Magnuson-Stevens Fishery Conservation and Management Act (16 USC 1801-1884)	Endangered, threatened, and sensitive wildlife species classification (WAC 232-12-297)	Consult and obtain biological opinions.
Historic sites or structures	Requirement to avoid, minimize, or mitigate impacts to historic sites or structures	NHPA (16 USC 470f; 36 CFR Parts 60, 63, and 800)	N/A	Considered if implementation of the selected remedy involves removal of historic sites or structures

Notes:
The East Waterway OU and the Terminal 25 South Site are being remediated under CERCLA and will comply with CERCLA requirements and guidance. ARARs are requirements other than CERCLA.

1. "To be considered" criterion does not qualify as an ARAR.
ARAR: Applicable or Relevant and Appropriate Requirement
CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act
CFR: Code of Federal Regulations
CWA: Clean Water Act
EPA: U.S. Environmental Protection Agency
KCC: King County Code
MTCA: Model Toxics Control Act
N/A: not applicable
NHPA: National Historic Preservation Act
OU: Operable Unit
PCB: polychlorinated biphenyl
RCRA: Resource Conservation and Recovery Act
RCW: Revised Code of Washington
SMC: Seattle Municipal Code
SMS: Sediment Management Standards
TSCA: Toxic Substances Control Act
USC: United States Code
WAC: Washington Administrative Code

Table 5-1
Data Quality Objectives: Site Physical Characteristics and Surveys

Step	Description
State the problem.	Physical characteristics of the Site are limited and not currently sufficient to prepare the EE/CA . Additional physical Site data are needed to update the CSM and inform the development of the EE/CA.
Identify the goal of the study.	The goals are as follows: • Determine soil lithology and physical properties of lithologic units and geotechnical information to inform slope stability evaluations, seismic performance evaluations, dredge and excavation prism development, engineered capping and/or backfill design, and work restrictions around existing infrastructure, utilities, and debris. • Evaluate shear strength to inform general sediment and soil stability design considerations, develop stable dredge and excavation cuts (i.e., side-slopes), assess bank stability, characterize sediment dredgeability and soil excavation, and inform engineered capping design. • Evaluate sediment and soil compressibility to determine the bearing capacity of the subgrade (i.e., potential for compaction/settling following engineered cap or backfill placement). • Evaluate consolidation of placed cap materials to assist with interpreting cap thickness verification surveys. • Evaluate the potential presence of subsurface features that may act as a source or conduit of contamination. • Collect geotechnical index properties (i.e., grain size, moisture content, bulk density, specific gravity, and plasticity) to inform overall engineering design, to assess bank and in-water slope stability, and to inform sediment and soil handling, transport, dewatering, and treatment systems. • Acquire additional topographic and bathymetric elevation information to obtain comprehensive elevation coverage of the Site and assist with cut/fill calculations, assess slope stability, and assess habitat conditions and considerations.
Identify information inputs.	Information inputs are as follows: • Preliminary CSM • Site soil lithology and geotechnical results from previous upland subsurface investigations • Conventional soil parameters, including total organic carbon, total solids, moisture content, grain size, etc. • Additional geotechnical investigations to inform geotechnical characteristics where data gaps exist (i.e., shear strength, consolidation settlement, index properties) • Existing topographic and bathymetric elevation information • Additional detailed elevation information through supplemental topographic and bathymetric surveys to provide full Site coverage (i.e., elevation contours) within the Future Sediment Area and Future Modified Upland Area
Define the boundaries of the study.	The horizontal extent of the study area is defined by the Future Sediment Area and Future Modified Upland Area. The vertical extent of the study area will cover the lithologic and aquifer units consistent with those considered for soil and groundwater contamination (Tables 5-2 and 5-3). Data of sufficient quality from previous investigations compared to those collected as part of this study will be used as a temporal boundary. Constraints on data collection: The field work and evaluation of data may be phased to allow for refinement to the scopes of work for subsequent EE/CA activities. Other constraints may include limitations due to sampling methods, drilling refusal, or encountering subsurface structures or debris (such as wood debris, piping, or foundations).

Table 5-1
Data Quality Objectives: Site Physical Characteristics and Surveys

Step	Description
Develop the analytic approach.	• Identify distinct lithologic units through soil sampling and submit representative samples from each unit for physical and geotechnical testing. • Analyze representative samples for geotechnical parameters (consolidations settlement, shear strength, and index properties). • Conduct supplemental topographic and bathymetric surveys.
Specify performance or acceptance criteria.	Physical and geotechnical data will be collected and analyzed using standard test measurements and procedures (ASTM International). Soil lithology characterization and sampling will be performed under the supervision of a registered geologist. Supplemental topographic and bathymetric surveys will be conducted by subconsultants with the appropriate equipment and experience.
Develop the plan for obtaining data.	The detailed plan for obtaining data is presented in the SQAPP (Appendix B). All subsurface (including geotechnical) investigations at the Site will be logged, and representative samples will be analyzed for physical and geotechnical parameters. Survey areas, spatial requirements, and controls will be detailed in the SQAPP.

Notes:
CSM: conceptual site model
EE/CA Engineering Evaluation and Cost Analysis
Site: Terminal 25 South Site
SQAPP: Sampling, Analysis, and Quality Assurance Project Plan

Table 5-2
Data Quality Objectives: Contamination in Soil

Step	Description
State the problem.	Additional soil characterization is necessary to determine the lateral and vertical extents of contamination in soil, to evaluate risks to human and ecological receptors, to evaluate source potential to groundwater, and to inform the EE/CA.
Identify the goal of the study.	The goals are as follows: • Determine the current nature and extent of contaminant concentrations in soil within or below the anticipated future habitat grade and the extent of PCB concentrations in soils to be removed that exceed the TSCA remediation waste threshold of 50,000 µg/kg. • Supplement existing DQ-1 chemical concentration data. • Identify source materials remaining in the subsurface. • Obtain adequate and representative data from soil for use in the streamlined Human Health and Ecological Risk Evaluation by evaluating pathway completeness and sediment recontamination in the Future Sediment Areas. • Obtain adequate and representative data from soil for use in the evaluation of removal action alternatives in the EE/CA.
Identify information inputs.	Information inputs are as follows: • Preliminary CSM • ARARs, remedial action objectives, and sediment SLs • Conventional soil parameters, including total organic carbon, total solids, moisture content, grain size, etc. • Concentrations of COPCs, including PCBs, metals, polycyclic aromatic hydrocarbons, certain semivolatile organic compounds, dioxins/furans, and certain volatile organic compounds in soil
Define the boundaries of the study.	Spatial boundaries: The horizontal extent of the investigation area is defined by the Future Sediment Area and Future Modified Upland Area. Sediment SLs are based on exposure pathways and potential receptors applicable to the Site. The vertical extent of the study area will be based on bounding contamination as determined by comparison of analytical data to sediment SLs. Temporal boundaries: Data of sufficient quality from previous investigations compared to those collected as part of this study will be used. Constraints on data collection: The field work and evaluation of data may be phased to allow for refinement to the scopes of work for subsequent EE/CA activities. Other constraints may include limitations due to sampling methods, drilling refusal, or encountering subsurface structures or debris (such as wood debris, piping, or foundations).
Develop the analytic approach.	Nature and extent of contamination: Assess subsurface soil lithology to evaluate potential preferential migration pathways. Analyte concentrations from soil samples will be used to determine the study boundaries (defined as the extent of contamination). Sample-specific concentrations will be compared to sediment SLs. Data will be evaluated and presented using figures and tables, and the findings will be used to update the CSM. Streamlined risk evaluation: Soil data will be used to estimate risks based on exposure by receptors to the future sediment condition.
Specify performance or acceptance criteria.	Ensure, through data review and validation, that the analytical data for collected samples are within acceptable quality limits as defined by applicable U.S. Environmental Protection Agency data quality protocols as presented in the SQAPP (Appendix B). Ensure sampling and analytical representativeness allow for adequate delineation of contaminant nature and extent, estimates of exposure for the streamlined risk evaluation, and subsequent identification of areas and media requiring remediation.

Table 5-2
Data Quality Objectives: Contamination in Soil

Step	Description
Develop the plan for obtaining data.	The detailed plan for obtaining data is presented in this EE/CA Work Plan and accompanying SQAPP (Appendix B). The following stepwise approach is proposed to determine the extent of contamination in soil: • Investigate and identify lithology, potential source areas, and subsurface debris and obstructions via borings. • Investigate potential source areas via borings at locations of previously identified areas of chemical impacts, site features, and subsurface anomalies identified by the geophysical surveys. Delineate source areas based on field observations. Collect soil samples to evaluate the types and concentrations of contaminants associated with each area of the Site. Collect samples of soil beneath potential historical source areas to evaluate vertical extent of contaminants. Analyze samples for all COPCs. • Characterize soil immediately downgradient of potential historical source areas, collecting soil samples from the Fill Unit and Upland Area Lower Alluvium Unit. Analyze samples for all COPCs.

Notes:
ARAR: Applicable or Relevant and Appropriate Requirement
COPC: contaminant of potential concern
CSM: conceptual site model
EE/CA Engineering Evaluation and Cost Analysis
PCB: polychlorinated biphenyl
Site: Terminal 25 South Site
SL: screening level
SQAPP: Sampling, Analysis, and Quality Assurance Project Plan
TSCA: Toxic Substance Control Act
µg/kg: micrograms per kilogram

Table 5-3
Data Quality Objectives: Contamination in Groundwater

Step	Description
State the problem.	Additional groundwater characterization is necessary to determine groundwater quality, evaluate potential transport to and recontamination of the Existing East Waterway and Future Sediment Areas, and to inform the EE/CA.
Identify the goal of the study.	The goals are as follows: • Characterize groundwater quality and compare to groundwater recontamination SLs, which are protective of sediment and surface water in areas where potential contaminant sources have been identified and in areas that have not been previously investigated but may be impacted at the Site. • Determine seasonal and tidal variability in contaminant concentrations and groundwater elevations. • Collect DQ-1 chemical concentration data. • Determine basic groundwater geochemistry pertinent to contaminant transport. • Obtain adequate and representative data from groundwater for use in the streamlined Human Health and Ecological Risk Evaluation by evaluating pathway completeness and sediment recontamination. • Obtain adequate and representative data from perimeter groundwater for use in the evaluation of removal action alternatives in the EE/CA.
Identify information inputs.	Information inputs are as follows: • Preliminary CSM • ARARs, remedial action objectives, and groundwater recontamination SLs • Conventional geochemical parameters in groundwater, including total suspended solids, total dissolved solids, pH, etc. • Concentrations of COPCs, including PCBs, metals, polycyclic aromatic hydrocarbons, dioxins/furans, and certain semivolatile organic compounds in groundwater • Installation of new groundwater wells at locations and depths where data gaps exist, monitoring of well conditions, and collection of groundwater samples from new wells • Determination of seasonal variations in groundwater quality by implementation of a monitoring program
Define the boundaries of the study.	Spatial boundaries: the horizontal extent of the investigation area is in the Future Modified Upland Area. The vertical extent of the study area will be based on bounding contamination as determined by comparison of analytical data to groundwater recontamination SLs. Temporal boundaries: Data of sufficient quality from previous investigations compared to those collected as part of this study will be used. Constraints on data collection: The field work and evaluation of data may be phased to allow for refinement to the scopes of work for subsequent EE/CA activities. Other constraints may include limitations due to sampling methods, drilling refusal, or encountering subsurface structures (such as wood debris, piping, or foundations).
Develop the analytic approach.	Groundwater quality: Analyte concentrations from groundwater samples will be used to determine the study boundaries (defined as the extent of contamination). Sample-specific concentrations will be compared to groundwater recontamination SLs. Data will be evaluated and presented using figures and tables, and the findings will be used to update the CSM. Groundwater data will be used to understand if groundwater is a source of contamination and to assess recontamination potential to the Future Sediment Area.
Specify performance or acceptance criteria.	Ensure, through data review and validation, that the analytical data for collected samples are within acceptable quality limits as defined by applicable U.S. Environmental Protection Agency data quality protocols as presented in the SQAPP (Appendix B). Ensure sampling and analytical representativeness allow for adequate delineation of contaminant nature and extent, estimates of exposure for the streamlined risk evaluation, and subsequent identification of areas and media requiring remediation.

Table 5-3
Data Quality Objectives: Contamination in Groundwater

Step	Description
Develop the plan for obtaining data.	The detailed plan for obtaining data is presented in this EE/CA Work Plan and accompanying SQAPP (Appendix B). The following stepwise approach is proposed to determine whether groundwater is a source of potential recontamination to the Future Sediment Area: • Evaluate soil data (Table 5-2) and install monitoring wells at the appropriate depths and locations within and downgradient of source areas to characterize groundwater. • Install monitoring wells along the perimeter of the Future Sediment Area in the Future Modified Upland Area and analyze groundwater for all COPCs to determine the recontamination potential of the Future Sediment Area.

Notes:
ARAR: Applicable or Relevant and Appropriate Requirement
COPC: contaminant of potential concern
CSM: conceptual site model
EE/CA Engineering Evaluation and Cost Analysis
PCB: polychlorinated biphenyl
Site: Terminal 25 South Site
SL: screening level
SQAPP: Sampling, Analysis, and Quality Assurance Project Plan

Figures

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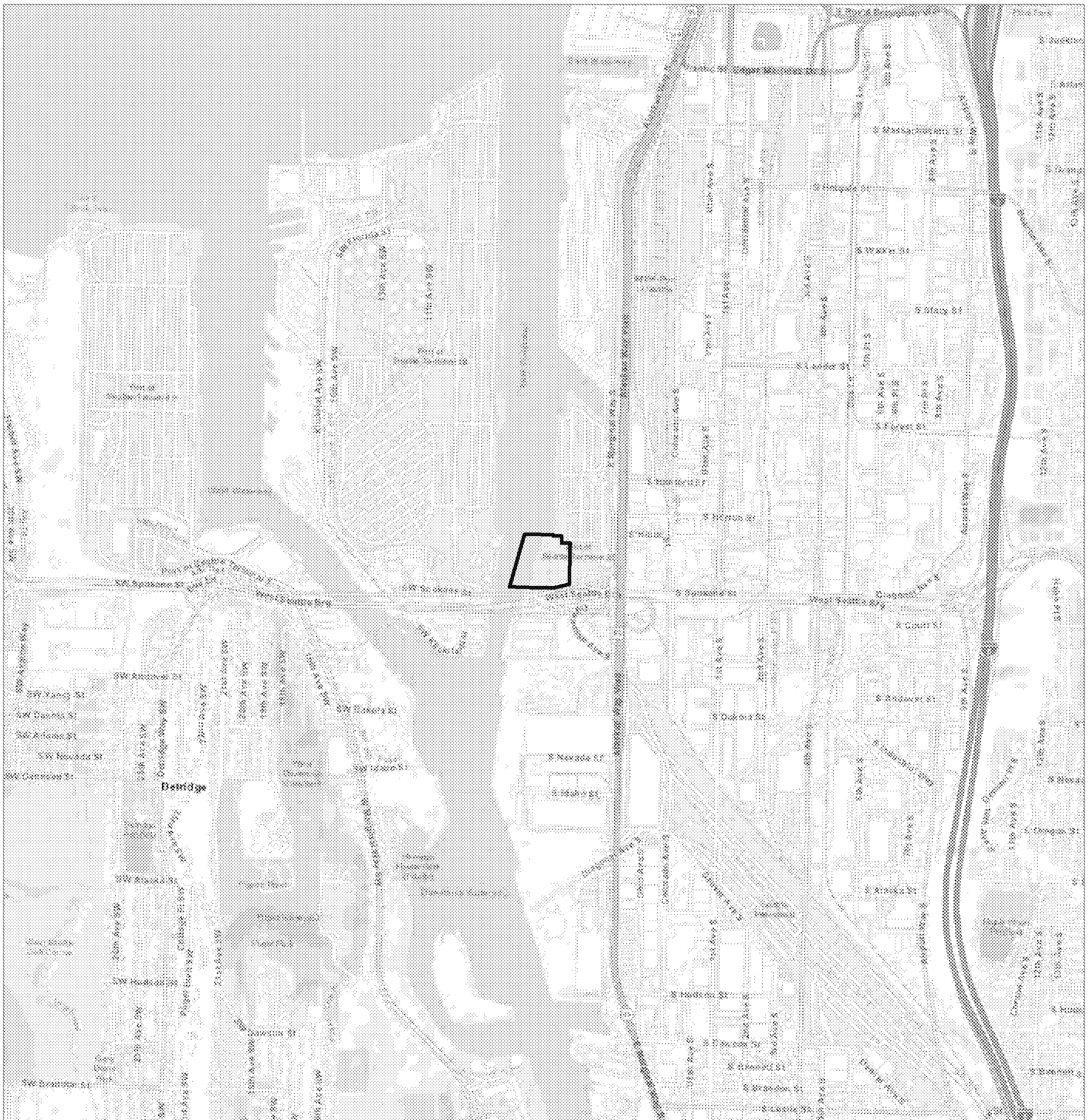
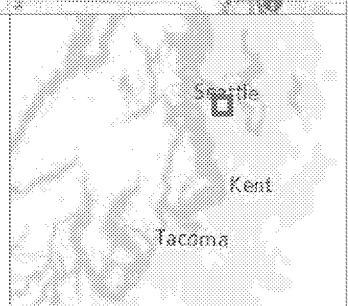


LEGEND:

Project Boundary

NOTE:
1. Basemap source: Esri Streets

0 2,000
Feet



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ANCHOR QEA

Figure 1-1
Site Vicinity Map
Engineering Evaluation and Cost Analysis Work Plan
Terminal 25 South Site

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Figure 1-2
Terminal 25 South Site
Engineering Evaluation and Cost Analysis Work Plan
Terminal 25 South Site

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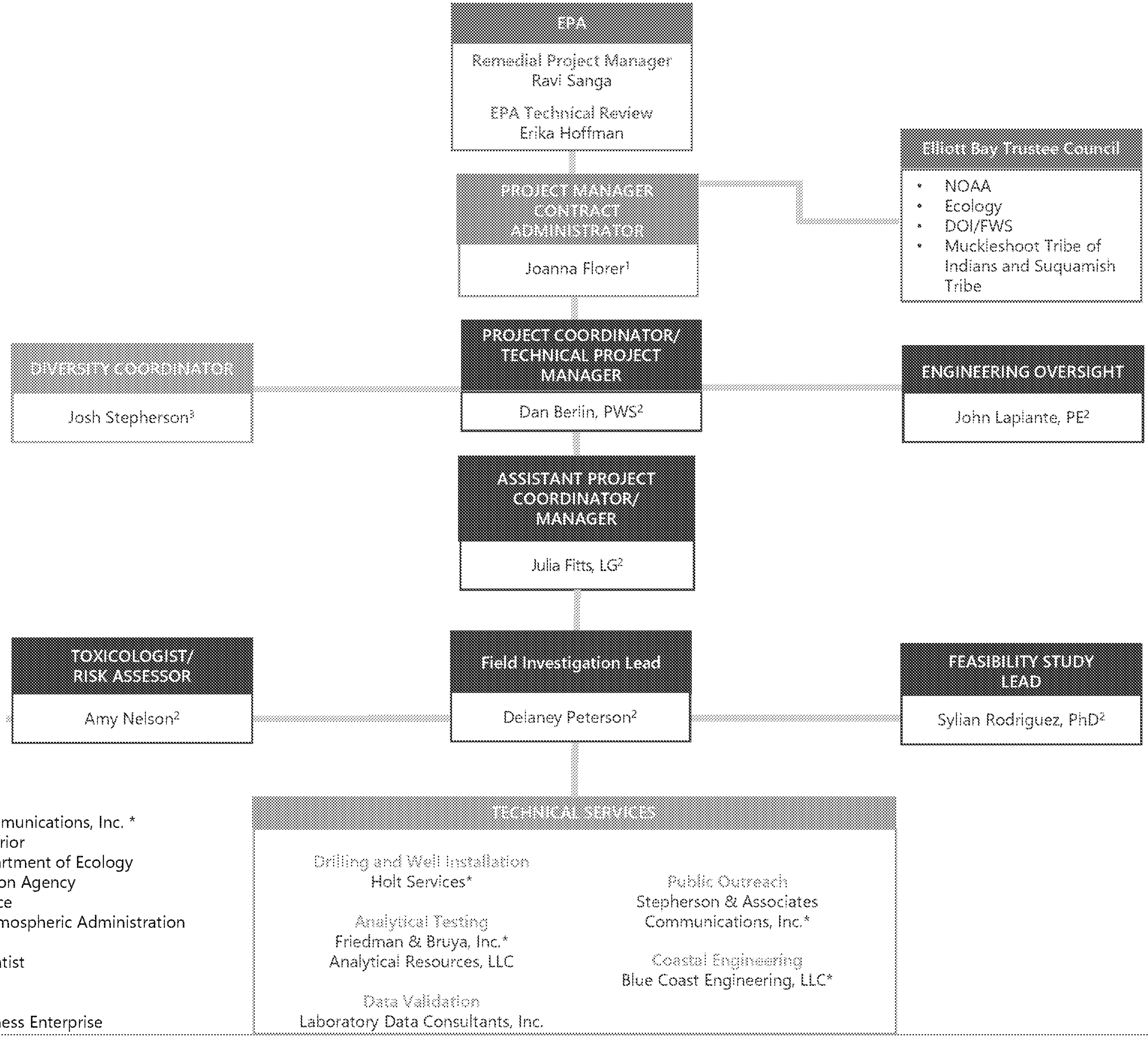
Figure 1-3
Restoration Conceptual Site Plan
Engineering Evaluation and Cost Analysis Work Plan
Terminal 25 South Site



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Notes:
1. Port of Seattle
2. Anchor QEA, LLC
3. Stepherson & Associates Communications, Inc. *
DOI: U.S. Department of the Interior
Ecology: Washington State Department of Ecology
EPA: U.S. Environmental Protection Agency
FWS: U.S. Fish and Wildlife Service
NOAA: National Oceanic and Atmospheric Administration
PE: Professional Engineer
PWS: Professional Wetland Scientist
LG: Licensed Geologist
Subconsultant Key:
* Minority/Women-Owned Business Enterprise

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Port of Seattle

Figure 1-4
Project Team Organization Chart
Engineering Evaluation and Cost Analysis Work Plan
Terminal 25 South Site

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Figure 2-1
Site Location and Area Zoning Map
Engineering Evaluation and Cost Analysis Work Plan
Terminal 25 South Site

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LEGEND:

- Terminal 25 South Site
- Tax Parcel
- MHHW Elevation
- Former Pier 24 Piling Field
- Upland Topographic Survey Extent (December 2017, Supplemented in 2019)

Existing Upland Contours (feet in MLLW)

- 5-foot
- 1-foot
- Bathymetric Survey Extent (February 2018)

Existing Bathymetric Contours (feet in MLLW)

- 5-foot
- 1-foot

NOTES:
1. Aerial imagery source: King County 2021
2. Bathymetric surveys conducted in February 2018 and 2006. Topographic surveys conducted in December 2017 and January 2019.
3. MHHW is at elevation 11.3 ft MLLW

MLLW: Mean Lower Low Water
MHHW: Mean Higher High Water

0 100
Feet

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Figure 2-2
Existing Bathymetric and Topographic Contour Elevations
Engineering Evaluation and Cost Analysis Work Plan
Terminal 25 South Site

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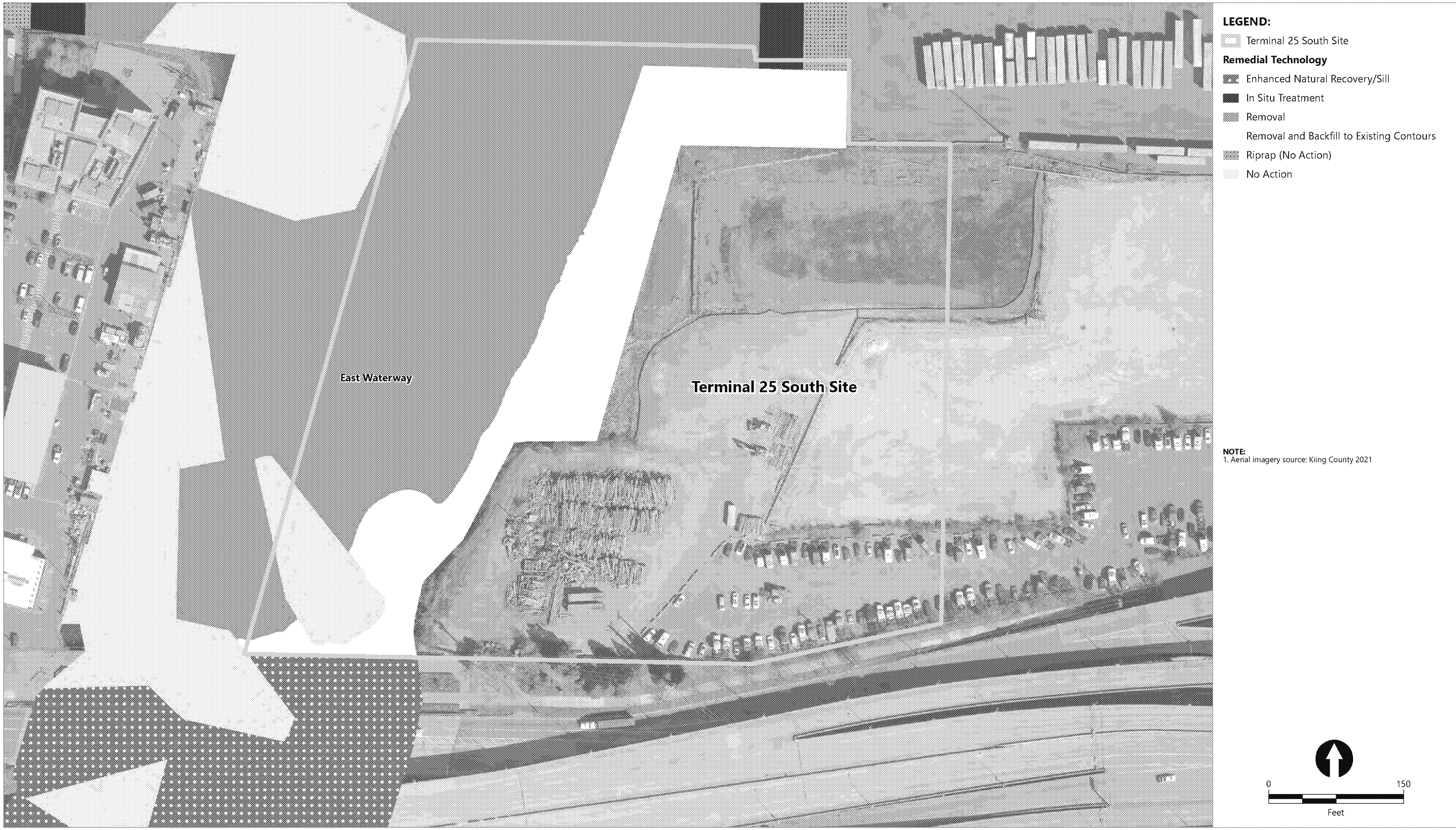

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ANCHOR QEA

Figure 2-3
Anticipated Remedial Technologies – East Waterway
Engineering Evaluation and Cost Analysis Work Plan
Terminal 25 South Site

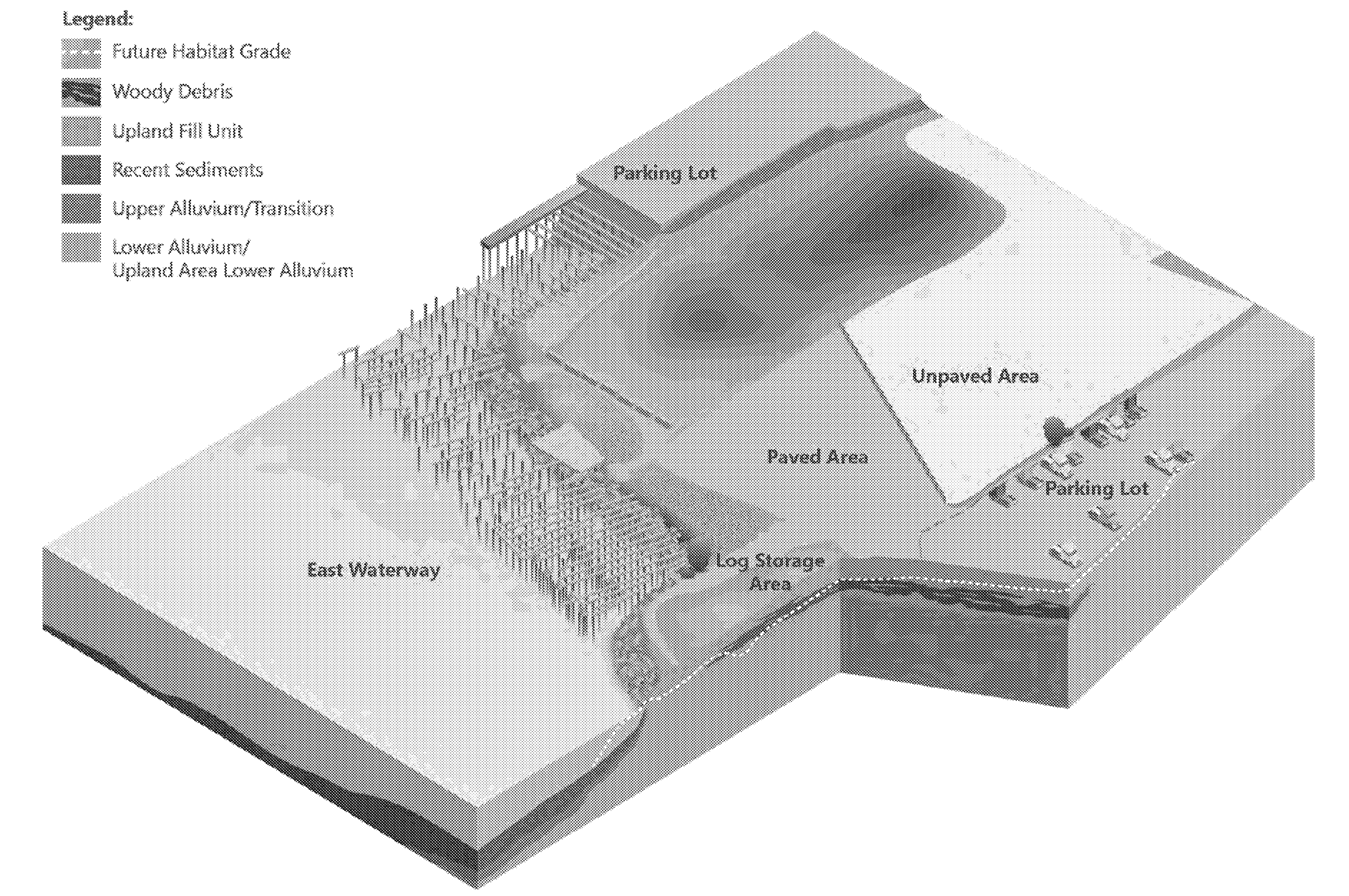

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Figure 2-4
Site Geology
Engineering Evaluation and Cost Analysis Work Plan
Port of Seattle Terminal 25 South

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LEGEND:

- Terminal 25 South Site
- Tax Parcel
- MHHW Elevation
- Approximate Key Historical Building Footprint
- Log Pile (GPS Delineation)

Restoration Habitat Definition

- Deep Subtidal – Fully Functional (<-14 feet MLLW)
- Shallow Subtidal – Fully Functional (-14 to -4 feet MLLW)
- Intertidal – Fully Functional (-4 to +6 feet MLLW)
- Off-Channel Emergent Marsh – Fully Functional (+6 to +12 feet MLLW)
- Riparian (> +12 feet MLLW)
- Stormwater Feature (0.5 acre)

NOTES:

1. Aerial imagery source: King County 2021
2. MLLW: Mean Lower Low Water
3. MHHW: Mean Higher High Water
4. UST: Underground Storage Tank

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ANCHOR QEA

Figure 2-5
Historical Operations, Remedial Actions, and Potential Source Areas
Engineering Evaluation and Cost Analysis Work Plan
Terminal 25 South Site

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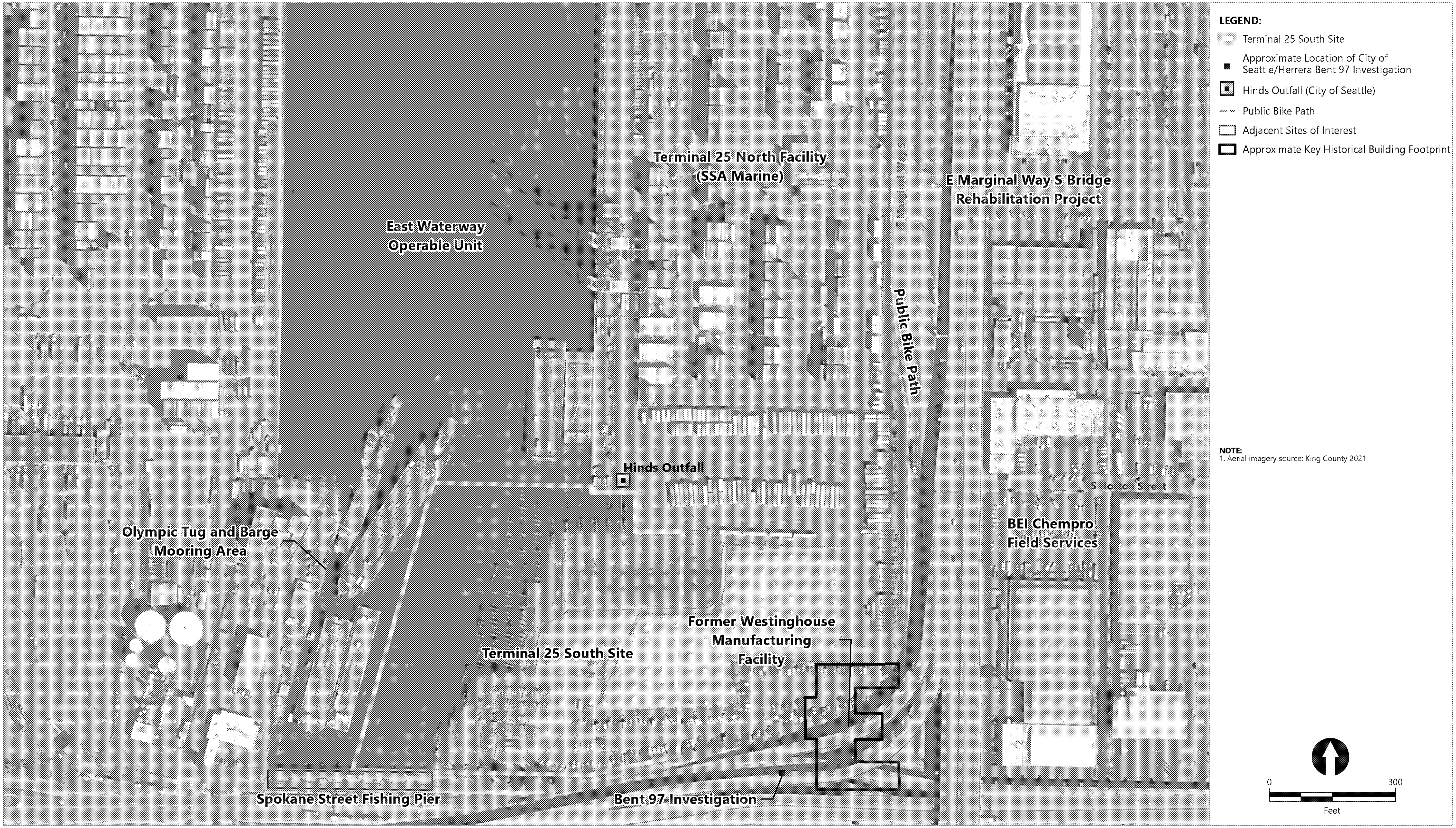

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Figure 2-6
Adjacent Sites of Interest
Engineering Evaluation and Cost Analysis Work Plan
Terminal 25 South Site

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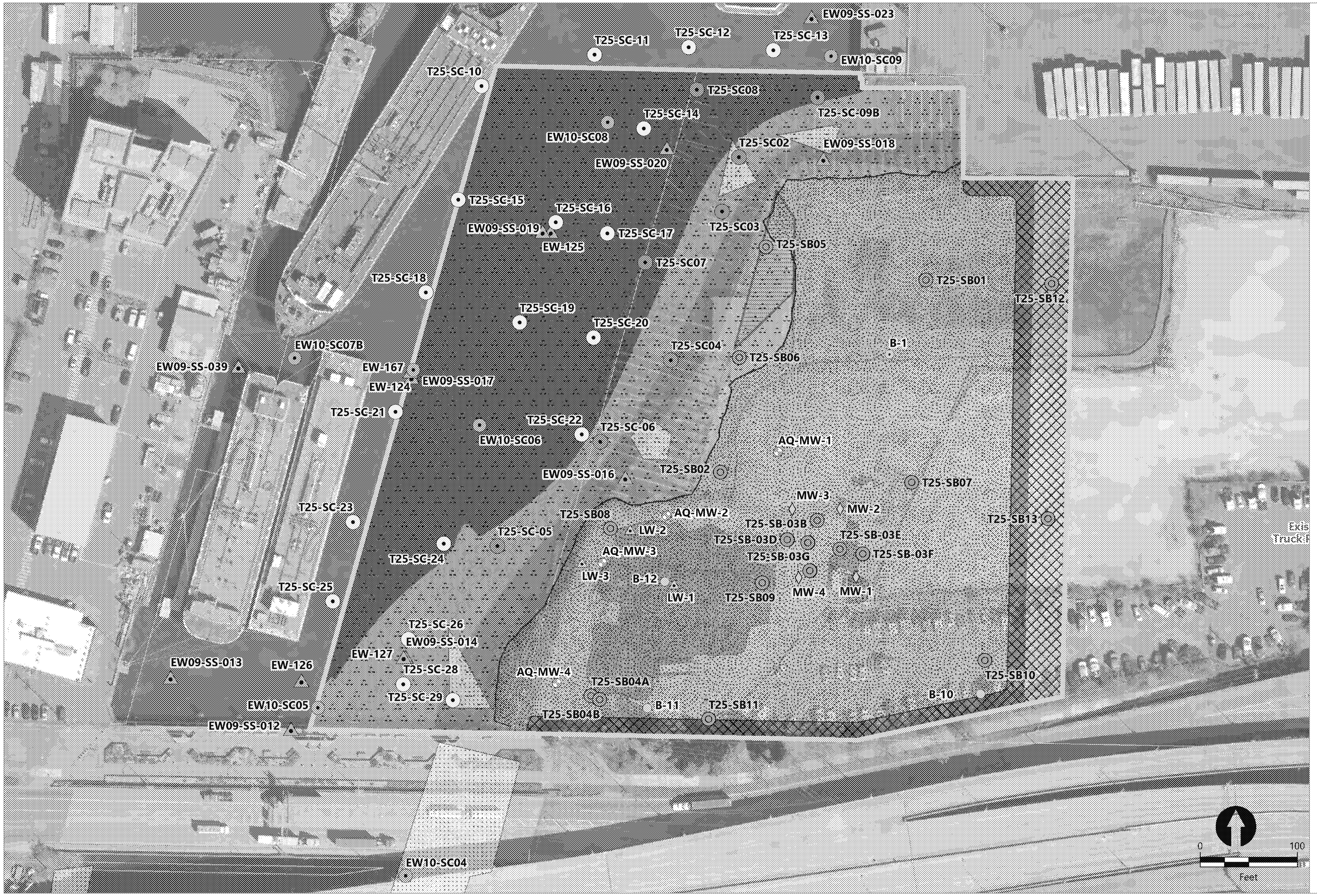

LEGEND:

- Terminal 25 South Site
- Tax Parcel
- MHHW Elevation
- Log Pile (GPS Delineation)
- Intertidal Surface Sediment Sampling Area
- 2019 – 2020 Upland Soil Boring

Sediment Core Locations

- 2019 Sediment Core Location
- 2021 Sediment Core Location

SRI Data (Windward and Anchor QEA 2014)

- Sediment Core
- Sediment Grab

Historical Borings

- Soil Boring (Blymyer 1989)
- Soil Boring and Monitoring Well (Landau 1990)
- Soil Boring and Monitoring Well (Sweet-Edwards/Emcon, Inc. 1990)
- Geotech Boring (Shannon and Wilson 2008)
- Soil Boring and Monitoring Well (Anchor QEA and Aspect 2012)

Other Historical Sediment Data

- 2011 Sediment Grab Composite Area

Restoration Habitat Definition

- Deep Subtidal – Fully Functional (<-14 feet MLLW)
- Shallow Subtidal – Fully Functional (-14 to -4 feet MLLW)
- Intertidal – Fully Functional (-4 to +6 feet MLLW)
- Off-Channel Emergent Marsh – Fully Functional (+6 to +12 feet MLLW)
- Riparian (>+12 feet MLLW)
- Stormwater Feature (0.5 acre)

Site Plan

- Existing Sediment Area
- Future Modified Upland Area
- Future Sediment Area

NOTES:

1. Aerial imagery source: King County 2021
2. MLLW: Mean Lower Low Water
3. MHHW: Mean Higher High Water
4. OHWM: Ordinary High Water Mark

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Figure 2-7
Sample Locations
Engineering Evaluation and Cost Analysis Work Plan
Terminal 25 South Site

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Figure 2-8
Future Sediment Area Sediment Screening Level Exceedances in Soil
Engineering Evaluation and Cost Analysis Work Plan
Terminal 25 South Site

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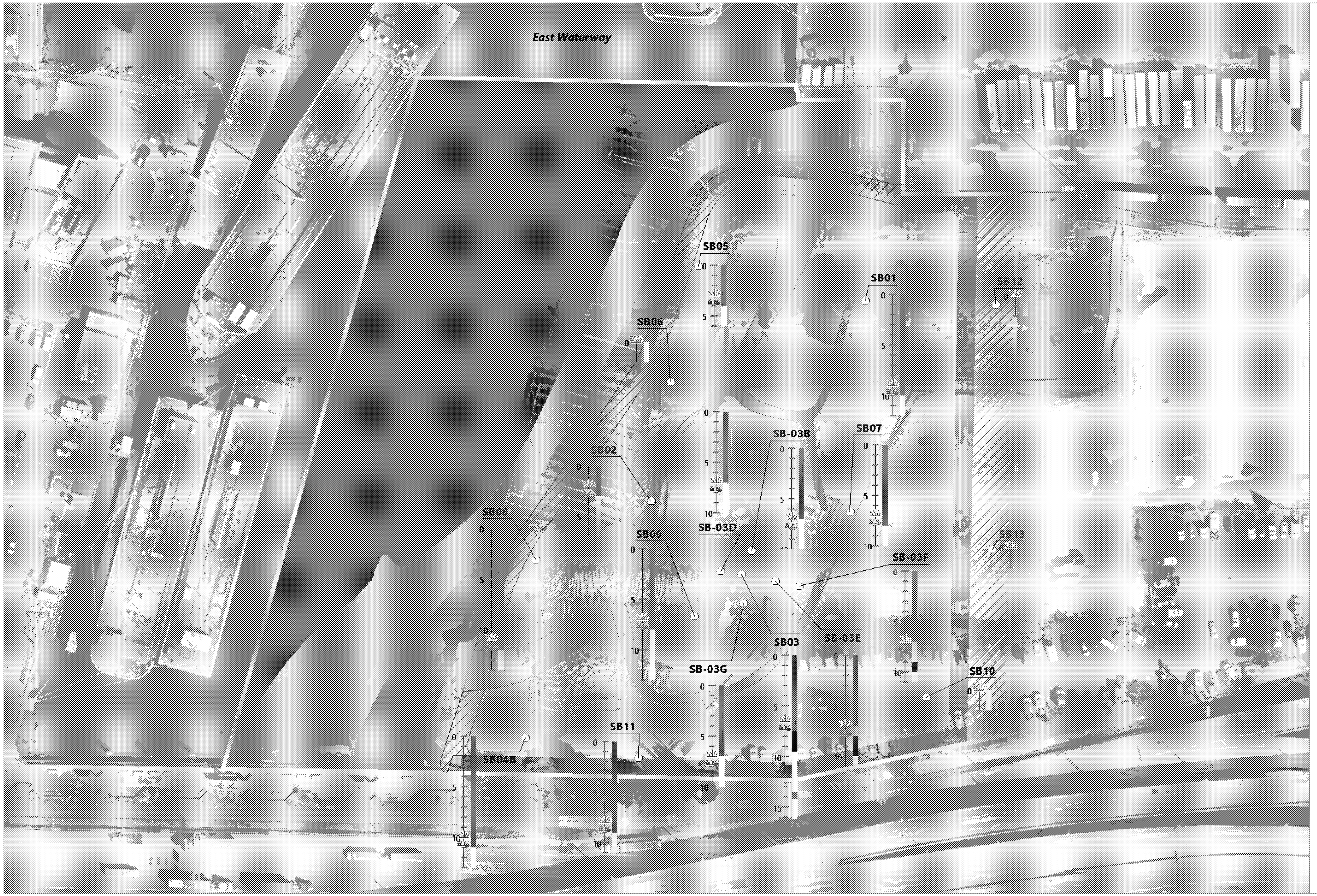

LEGEND:

- Terminal 25 South Site
- Berm
- Incised Channel

Restoration Habitat Definition

- Deep Subtidal – Fully Functional (<-14 feet MLLW)
- Shallow Subtidal – Fully Functional (-14 to -4 feet MLLW)
- Intertidal – Fully Functional (-4 to +6 feet MLLW)
- Off-Channel Emergent Marsh – Fully Functional (+6 to +12 feet MLLW)
- Riparian (>+12 feet MLLW)
- Stormwater Berm (0.5 acre)

- Sampling Location

Total PCBs (µg/kg)

- <=50,000
- >50,000
- No Data

Core Stick Scale Bar
(hatching in feet)

0
5

- Habitat Restoration Design Surface
- Post-Excavation Surface

NOTES:
1. Aerial Imagery Source: King County 2021
2. SB01: PCBs were not detected from 10 to12 feet.
3. MLLW: Mean Lower Low Water

µg/kg: Micrograms per Kilogram

0 100
Feet

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Figure 2-9
Future Sediment Area Total PCB TSCA Screening
Engineering Evaluation and Cost Analysis Work Plan
Terminal 25 South Site

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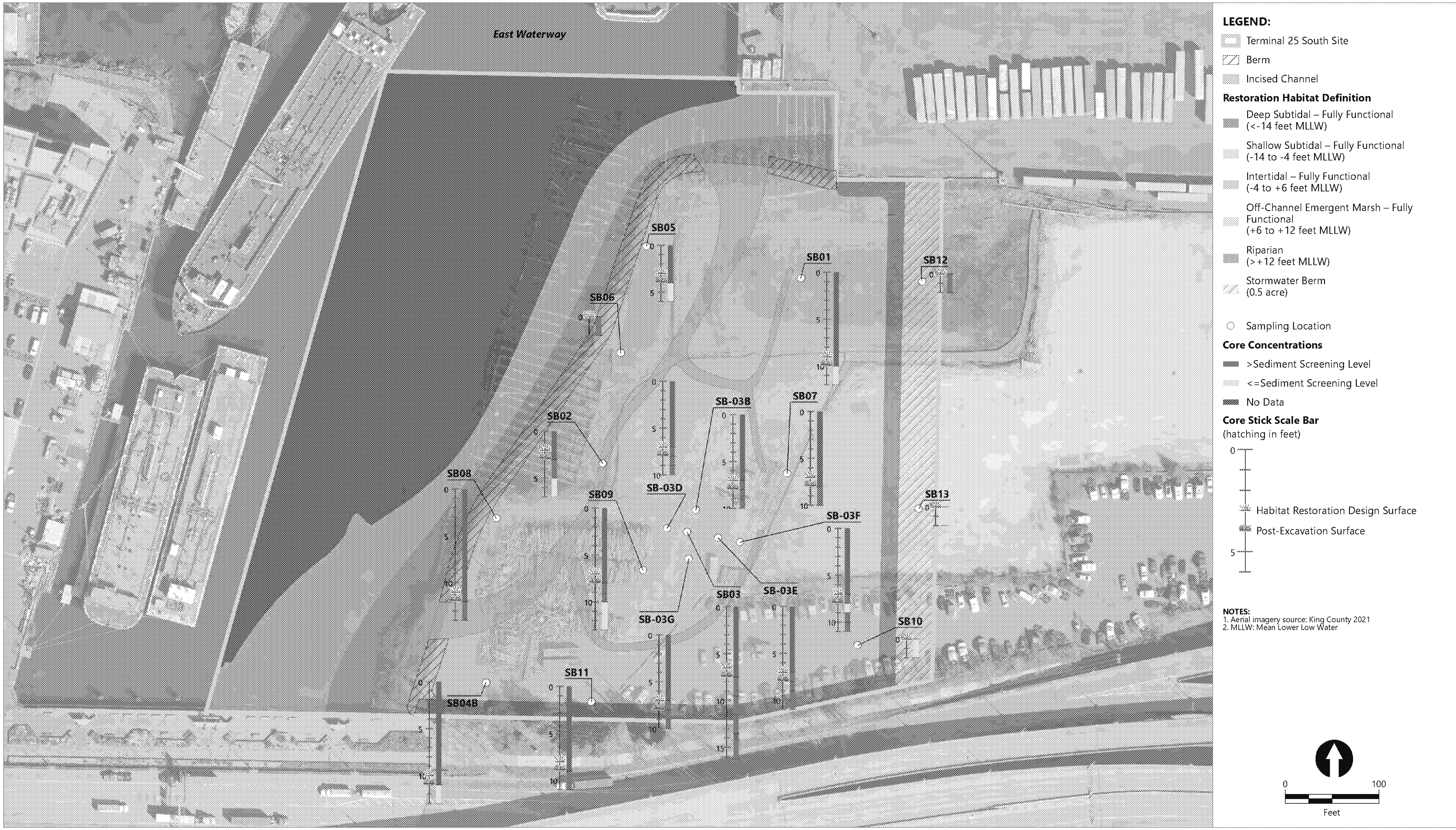

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Figure 2-10
Summary of Sediment Screening Level Exceedances in Future Sediment Area
Engineering Evaluation and Cost Analysis Work Plan
Terminal 25 South Site

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Figure 2-11
Depth of Contamination in Future Sediment Area Based on Deepest Exceedance of Any Chemical
Engineering Evaluation and Cost Analysis Work Plan
Terminal 25 South Site

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LEGEND:

- Terminal 25 South Site
- Berm
- Incised Channel

Restoration Habitat Definition

- Deep Subtidal – Fully Functional (<-14 feet MLLW)
- Shallow Subtidal – Fully Functional (-14 to -4 feet MLLW)
- Intertidal – Fully Functional (-4 to +6 feet MLLW)
- Off-Channel Emergent Marsh – Fully Functional (+6 to +12 feet MLLW)
- Riparian (>+12 feet MLLW)
- Stormwater Berm (0.5 acre)

Sediment Sampling Location

- Grab
- Core
- Deepest Sample Interval Does Not Exceed a Sediment Screening Level
- Deepest Sample Interval Exceeds Total PAH Injury Threshold Only

Core Concentrations

- >Sediment Screening Level
- <=Sediment Screening Level
- No Data

Core Stick Scale Bar
(hatching in feet)

0
5

NOTES:
1. Aerial Imagery source: King County 2021
2. MLLW: Mean Lower Low Water
3. SB05 and SB06 were collected as upland borings but are located below mean higher high water (11.3' MLLW).

0 100
Feet

Publish Date: 2022/08/06, 11:54 AM | User: joliver
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Figure 2-12
East Waterway Sediment Area Screening Summary
Engineering Evaluation and Cost Analysis Work Plan
Terminal 25 South Site

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Figure 2-13
East Waterway Depth of Sediment Contamination Based on Deepest Exceedance of Any Chemical
Engineering Evaluation and Cost Analysis Work Plan
Terminal 25 South Site

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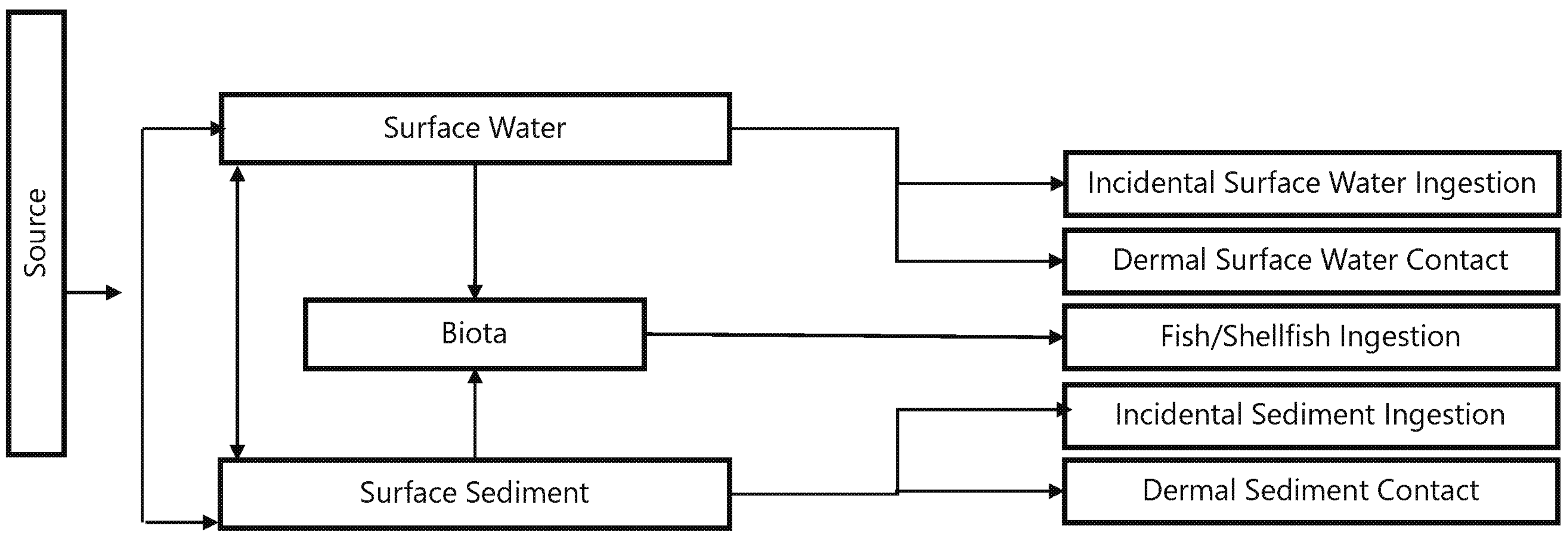
Figure 2-14
Utilities and Storm Drain Solid Sample Locations
Engineering Evaluation and Cost Analysis Work Plan
Terminal 25 South Site

Exposure Media

Preliminary Exposure Pathways



Exposure Scenarios

East Waterway Receptors and Pathways (Aquatic Environment) Quantitively Evaluated in the HHRA[1,2]				
Water Recreation	Occupational Exposure	Fish and Crab Collection (Netfishing)	Shellfish Collection	Seafood Consumption
	x	x	x	
	x	x	x	
x				
x				

	Incomplete exposure pathway in the EW HHRA.
X	Complete exposure pathway, not quantified in EW HHRA due to low exposure
	Complete and quantified exposure pathway from the EW HHRA.

Notes:

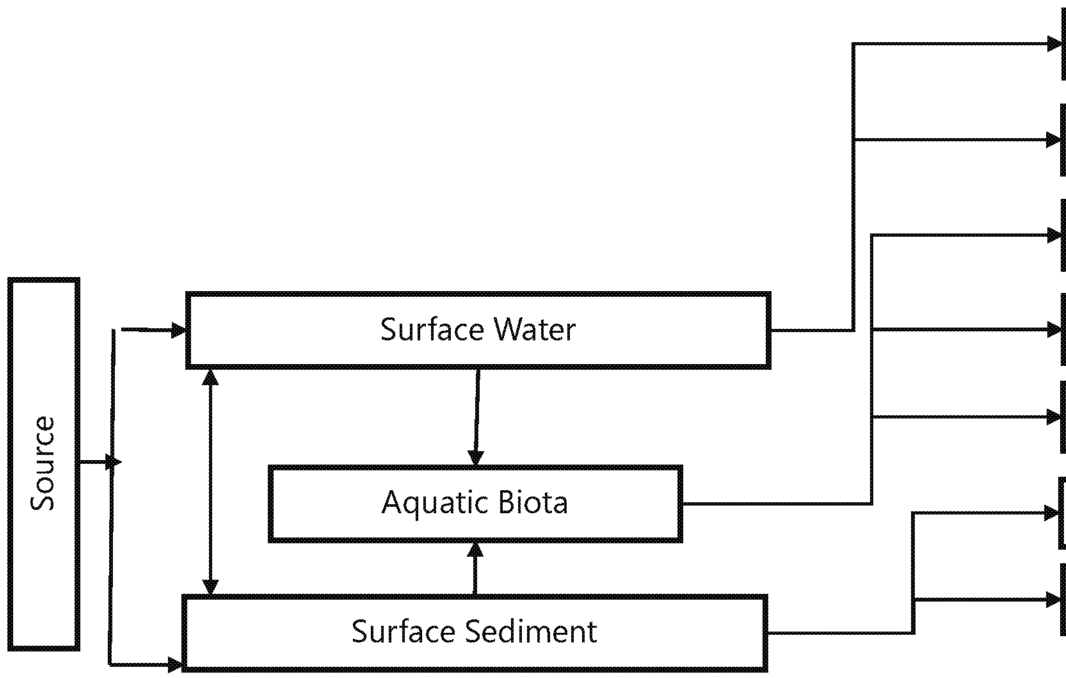
1 Potential human health and ecological exposures to future upland media (riparian zone and stormwater berm) post restoration are considered incomplete due to planned removal and backfill activities associated with Site restoration for this SRE based on proposed future use within the EW OU.

2 Receptors and exposure pathway that were quantitively evaluated in the East Waterway Human Health Risk Assessment (EW HHRA; Windward and Anchor QEA 2014).

Figure 3-1
Preliminary Human Health Conceptual Site Model
Engineering Evaluation and Cost Analysis Work Plan
Terminal 25 South Site

Exposure Media

Preliminary Exposure Pathways



Exposure Scenarios

East Waterway Receptors and Complete and Significant Pathways (Aquatic Environment) Evaluated in the ERA[1,2]

Preliminary Exposure Pathway	Fish and Benthic Invertebrate Community					Wildlife			
	Juvenile Chinook Salmon	Brown Rockfish	English Sole	Benthic Community	Crabs	Osprey	Pigeon Guillemot	River Otter	Harbor Seal
Direct Water Contact	■	■	■	■	■				
Water Ingestion						■	■	■	■
Benthic Ingestion	■	■	■	■	■	x	■	■	?
Fish Ingestion		■		x	■	■	■	■	■
Other Organism Ingestion	?			■	x	x	■	■	
Direct Sediment Contact		?	?	■	?	x			
Sediment Ingestion		?	?	■	?	■	■	■	■

x	Incomplete exposure pathway in EW ERA
?	Complete exposure pathway, significance unknown in EW ERA[3]
	Complete and insignificant exposure pathway in EW ERA
■	Complete and quantified exposure pathway from the EW ERA.

Notes:

1. Potential human health and ecological exposures to future upland media (riparian zone and stormwater berm) post restoration are considered incomplete due to planned removal and backfill activities associated with Site restoration for this SRE based on proposed future use within the EW OU
2. Receptors and exposure pathway that were quantitively evaluated in the East Waterway Ecological Risk Assessment (EW ERA; Windward and Anchor QEA 2014)
3. There is a direct link between the receptor and the chemical via this pathway; however, there are insufficient data available to quantify the significance of the pathway in the overall assessment of exposure. Pathways classified as complete and significance unknown are discussed qualitatively in the uncertainty analysis sections of the EW ERA.

Figure 3-2
Preliminary Ecological Conceptual Site Model
Engineering Evaluation and Cost Analysis Work Plan
Terminal 25 South Site

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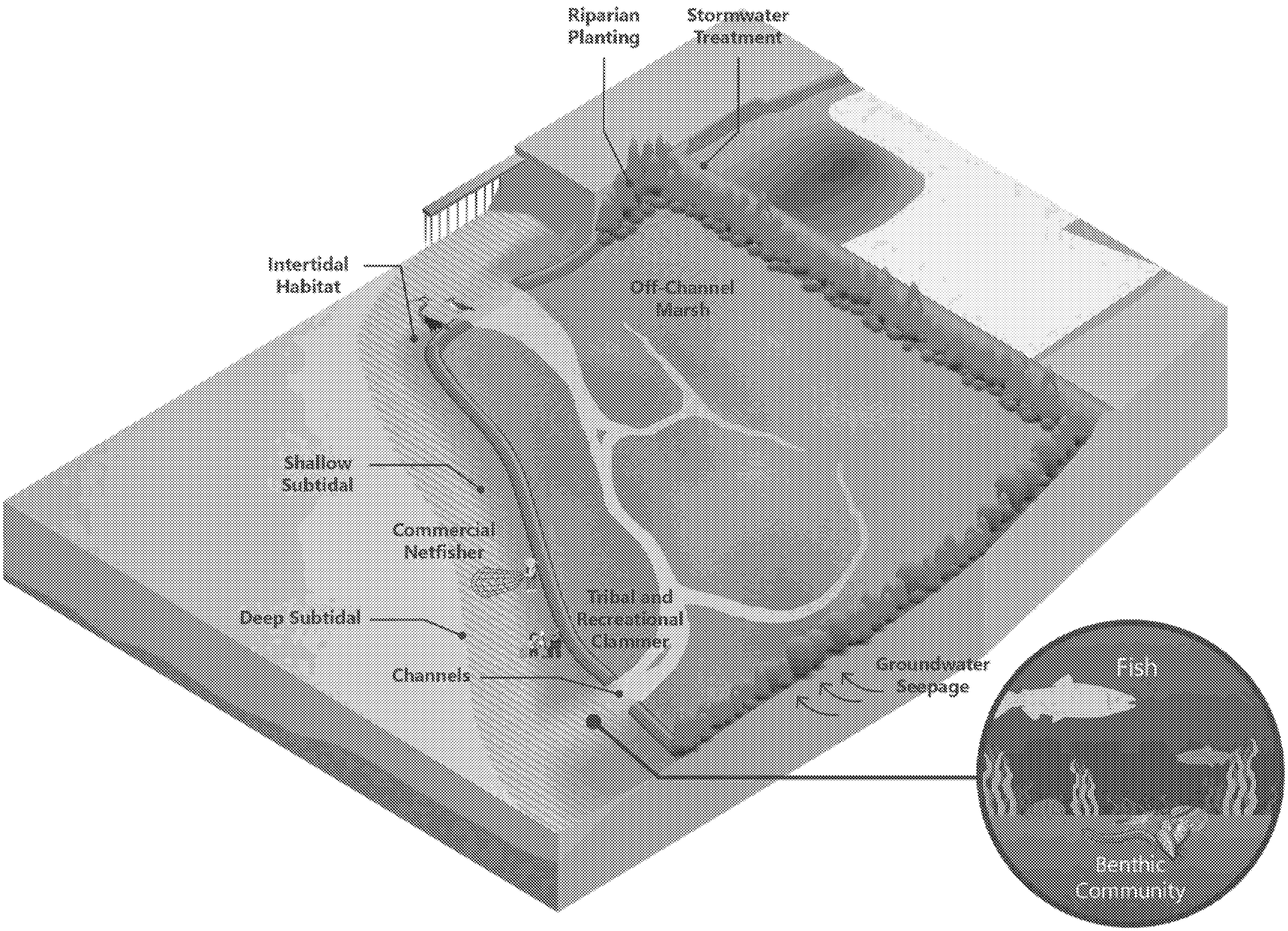

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Figure 3-3
Preliminary 3D Conceptual Site Model
Engineering Evaluation and Cost Analysis Work Plan
Terminal 25 South Site

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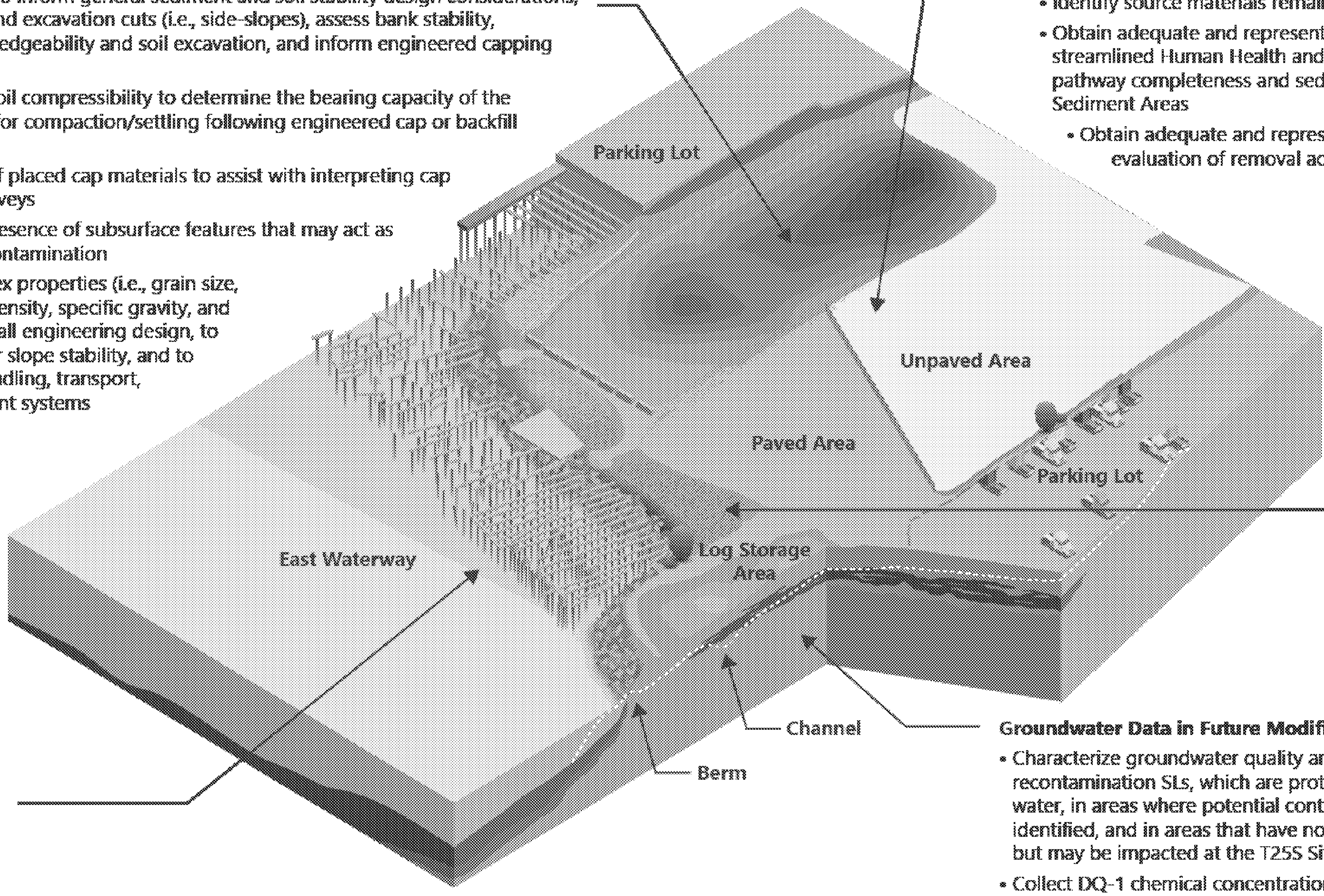
Geotechnical Data in Future Sediment Area and Future Modified Upland Area

- Determine soil lithology and physical properties of lithologic units and geotechnical information to characterize Site subsurface conditions and to inform slope stability evaluations, seismic performance evaluations, dredge and excavation prism development, engineered cap and/or backfill design, and work restrictions around existing infrastructure, utilities, and debris
- Evaluate shear strength to inform general sediment and soil stability design considerations, develop stable dredge and excavation cuts (i.e., side-slopes), assess bank stability, characterize sediment dredgeability and soil excavation, and inform engineered capping design
- Evaluate sediment and soil compressibility to determine the bearing capacity of the subgrade (i.e., potential for compaction/settling following engineered cap or backfill placement)
- Evaluate consolidation of placed cap materials to assist with interpreting cap thickness verification surveys
- Evaluate the potential presence of subsurface features that may act as a source or conduit of contamination
- Gather geotechnical index properties (i.e., grain size, moisture content, bulk density, specific gravity, and plasticity) to inform overall engineering design, to assess bank and in-water slope stability, and to inform sediment/soil handling, transport, dewatering, and treatment systems

Soil Data in Future Sediment Area and Future Modified Upland Area

- Determine the current nature and extent of contaminant concentrations in soil within or below the future habitat grade and the extent of PCB concentrations in soils to be removed that exceed the TSCA remediation waste threshold of 50,000 µg/kg
- Supplement existing DQ-1 chemical concentration data
- Identify source materials remaining in the subsurface
- Obtain adequate and representative data from soil for use in the streamlined Human Health and Ecological Risk Evaluation by evaluating pathway completeness and sediment recontamination in the Future Sediment Areas
  - Obtain adequate and representative data from soil for use in the evaluation of removal action alternatives in the EE/CA Report



Topography and Bathymetry

- Acquire additional topographic and bathymetric elevation information to obtain full elevation coverage of the T-25S Site and assist with cut/fill calculations, assess slope stability, and assess habitat conditions and considerations

Sediment Data

Limited data gaps where previous cores did not delineate the vertical extent of contamination, but access is limited.

Groundwater Data in Future Modified Upland Area

- Characterize groundwater quality and compare to groundwater recontamination SLs, which are protective of sediment and surface water, in areas where potential contaminant sources have been identified, and in areas that have not been previously investigated but may be impacted at the T25S Site
- Collect DQ-1 chemical concentration data
- Obtain adequate and representative data from groundwater for use in the streamlined Human Health and Ecological Risk Evaluation by evaluating pathway completeness and sediment recontamination
- Obtain adequate and representative data from perimeter groundwater for use in the evaluation of removal action alternatives in the EE/CA Report

Legend:

- Future Habitat Grade
- Woody Debris
- Upland Fill Unit
- Recent Sediments
- Upper Alluvium/Transition
- Lower Alluvium/Upland Area Lower Alluvium

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Figure 5-1
Summary of Existing Data Gaps
Engineering Evaluation and Cost Analysis Work Plan
Port of Seattle Terminal 25 South

Appendix A
Supplemental Data

Appendix A-1
Boring Logs and Monitoring Well Construction Table for Existing Explorations

Appendix A-2
Data Quality-2 Data

Appendix A-3
RCRA and TSCA Data Screening

Appendix B
Sampling, Analysis, and Quality Assurance Project Plan

Appendix C
Health and Safety Plan